

M. E

Gc
929.2
R621s
2036132

REYNOLDS HISTORICAL
GENEALOGY COLLECTION

✓

ALLEN COUNTY PUBLIC LIBRARY



3 1833 01426 9085

m

THE ROEBLINGS

*A Century of
Engineers, Bridge-builders and Industrialists*

The Story of Three Generations
of an Illustrious Family

1831-1931

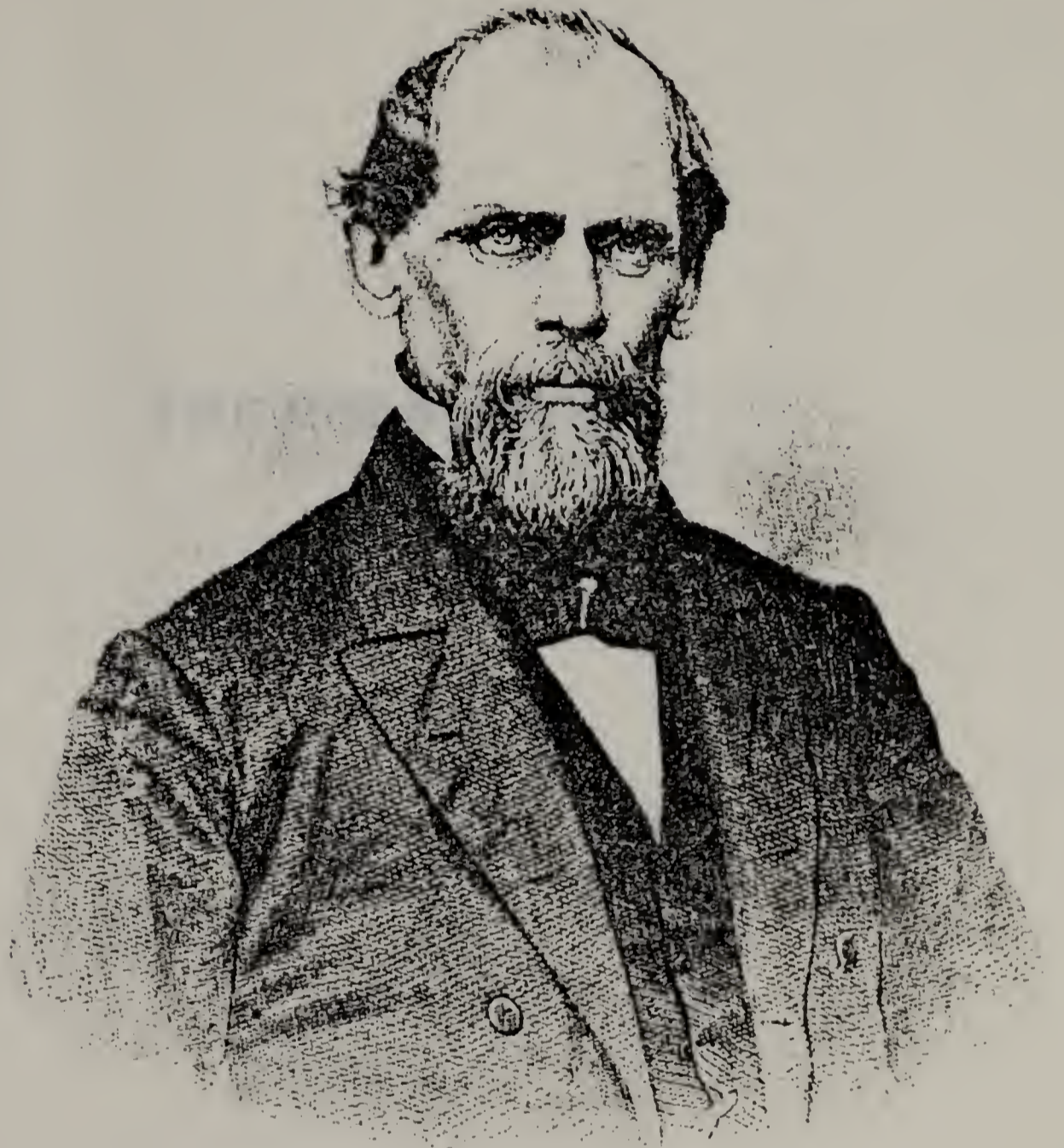
BY

HAMILTON SCHUYLER

PRINCETON
PRINCETON UNIVERSITY PRESS
1931

019
79 8607 11

2236132



Mr. H. F. F. (1)

Recd Mar 22 - 1979

*LONDON: HUMPHREY MILFORD
OXFORD UNIVERSITY PRESS*

COPYRIGHT, 1931, PRINCETON UNIVERSITY PRESS



PRINTED AT THE PRINCETON UNIVERSITY PRESS
PRINCETON, NEW JERSEY, U.S.A.

U. S. ENGINEERING

E. 23
R. 11
2

The author's indebtedness to the many friends and acquaintances who have assisted him in the preparation of this book is gratefully acknowledged. Special mention is made of the assistance rendered by the late Mr. J. H. ... and Mr. ...

TO
FERDINAND WILLIAM AND RUTH METCALF ROEBLING,
THIS BOOK, DEALING WITH THE HISTORY
AND ACHIEVEMENTS OF AN ILLUSTRIOUS FAMILY,
IS INSCRIBED BY THE AUTHOR,
WITH GRATEFUL MEMORIES
OF THEIR FRIENDSHIP AND CONFIDENCE

The author's indebtedness to the many friends and acquaintances who have assisted him in the preparation of this book is gratefully acknowledged. Special mention is made of the assistance rendered by the late Mr. J. H. ... and Mr. ...

PREFACE

It is exactly a century ago since John A. Roebling immigrated to this country and began his fruitful career as an engineer, bridge-builder, and industrialist. During this period the Roeblings, father, sons, and grandsons, have in unbroken succession been responsible for certain outstanding achievements of a public nature, culminating today in the greatest suspension bridge in the world, namely, that spanning the Hudson River at New York and bearing the official name, "George Washington Bridge." On the island of Manhattan alone, including this latest wonder, four great bridges have been constructed by the Roeblings, beginning with the Brooklyn Bridge as the first of the series. Such a record of accomplishment, embracing the lives of three generations of one family, seems to call for more than mere passing comment, and hence this book has been prepared with a view to providing the public, or such sections of it as may presumably be interested, with an intimate account of the lives and personalities of the men who by their progressive achievements in bridge engineering and industry have made the world familiar with the Roebling name. The subject of this book is thus not directly concerned with the material structures which constitute the visible monuments to the Roebling fame or with the great wire industry built up by them over a long series of years but is rather an attempt to reveal what manner of men these Roeblings were, and to discern the personal traits and attending conditions which enabled them to achieve success in one and the same field of activity embracing nearly a century of sustained effort.

PREFACE

Given the bold initiative and the inventive genius of the founder which happily coincided with the needs of the country for a development of better means of communication and transportation, the successful beginnings are not hard to understand. When John A. Roebling died in 1869 only a promising start had been made and the greater structures were yet to be planned and built. It was not until 1883 that the Brooklyn Bridge was completed, only the preliminary studies being in existence when he passed away. Had not his eldest son, Washington A. Roebling, as familiar with the plans and inheriting his father's engineering genius, been available to complete the work the Roebling name would probably long ago have been forgotten or remembered only by the few who were professionally concerned with the fruitful ideas of their predecessors. Not always is it given to the second and third generation to continue in the same admirable path as their progenitor and to work out and perfect over a long course of years and under changing conditions the original conceptions which inspired the founder of the enterprise. To preserve and augment an inheritance when the tendency so often is to lose and dissipate it implies the possession by the heirs of the same qualities of foresight, skill, and industry which distinguished their progenitor.

It is now fully ninety years since John A. Roebling constructed a crude rope-walk on his farm in Saxonburg and began the manufacture of wire rope to take the place of hempen cables for haulage purposes. Removing to Trenton in 1848-1849, he laid the foundation of the wire-making industry represented today by the present huge plants in Trenton and the adjacent town of Roebling, while in the interval the score of employes has increased to many thousands.

While naturally as a pioneer in the construction of wire-

PREFACE

cable suspension bridges and the founder of the great industry which bears his name, the life of John A. Roebling and his personal achievements will receive paramount consideration in this book, the careers of his sons and grandsons, and more especially that of his distinguished eldest son, Colonel Washington A. Roebling, his immediate successor, will also be fully sketched.

As the book is intended mainly for the general reader, technical descriptions of the various bridges, while not avoided, have been made as concise as possible with a due regard for the interests of professional engineers in the achievements of a master of the craft. Moreover for the engineering details the recognized authorities, including John A. Roebling himself, have, wherever possible, been quoted directly. The main sources used and quoted from are given in the text and hence the printing of a formal bibliography is not deemed necessary.

The development of a great industry from its inception to recent times is mainly told from the writings of Colonel Washington A. Roebling whose personal memories covered a period of eighty years.

H. S.

Trenton, New Jersey,
August 6, 1931.

AUTHOR'S NOTE AND ACKNOWLEDGMENTS

The initiative looking to the writing of this book came directly from the author; so far as he is aware the idea had not previously entered the mind of those immediately concerned. When Mr. Ferdinand W. Roebing, Jr., the present head of the Roebing Company, graciously gave the desired permission to proceed with the work, it was accompanied with no suggestions or restrictions, although it was understood that the author would be supplied with all the material in his possession available for the task. In other words, and by implication, a free hand was given the author to proceed along his own lines and to produce a book in accordance with his best judgment. Hence it follows that he and he alone is responsible for the contents and method of treatment. For sins of omission and commission he is estopped from offering any plea in extenuation and must rightfully bear the full blame. The book, it is proper to emphasize, enjoys no imprimatur from representatives of the present Roebing family, and is authoritative only in the sense that permission was accorded to write and publish it.

While the author is deeply grateful for the unusual confidence reposed in him, he has found himself a good deal embarrassed by this unsought-for freedom, since thereby he has been left entirely to his own resources and unguided selection of material in the delicate task of relating the personal histories and achievements of the members of the family with three generations of whom this book is concerned.

It is the author's privilege to make his acknowledgments to the persons who have been helpful in the preparation of this book.

AUTHOR'S NOTE AND ACKNOWLEDGMENTS

Besides his indebtedness to Mr. Ferdinand W. Roebling, Jr., for placing at his disposal valuable material bearing upon the history of the Roebling family and the affairs of the company, he must also express his cordial thanks to several officials of the John A. Roebling's Sons Company for their ready response to his needs and inquiries—to Mr. Austin C. Cooley for his services in reading and correcting certain parts of the narrative and for his many helpful suggestions—to Mr. Frank W. Bunn for his aid in preparing the chapter on "The Industrial Town of Roebling"—to Mr. C. C. Sunderland, the company's chief bridge engineer for guidance given in respect to the technical description of the various bridges—to Mr. William Gummere for his aid given in the chapter, "The Roeblings in the World War."

To Mr. Charles Edward Swan of Trenton he is under special obligations for his generous permission to make full use of the important letters in his possession written to his grandfather Charles Swan, for over twenty years the trusted superintendent of the plant under John A. Roebling. These letters, in addition to the many written by the elder Roebling, include also others written by his sons Washington A. Roebling and Ferdinand W. Roebling, and were plainly essential for telling the story in its completeness.

To Dr. Rudolph Heinrich Roebling of Hagen, Westphalia, Germany, and his wife Frau Frieda Roebling he is deeply grateful for providing the genealogical record of the Roebling family and for the painstaking personal researches into the early history of John A. Roebling in his native land.

To Dr. Brinkmann, archivist of the public records of Muhlhausen, to Dr. Wilhelm Auener of Kiel, the author of a monograph (1931) on Johann August Roebling, and to Dr. Ascan

AUTHOR'S NOTE AND ACKNOWLEDGMENTS

W. Lutteroth of Hamburg his thanks are due for favors graciously extended.

To Mr. Howard L. Hughes and the staff of the Trenton Free Public Library acknowledgment is made for helpfulness in placing at his disposal certain important books and also for their influence in securing information from libraries in other cities.

He is indebted to Mrs. Virginia Woodall for assistance in correcting the proofs, and to Miss Mary J. Messler, chief of the Reference Department of the Trenton Free Public Library, for making the Index.

The author has also to thank his good friend Mr. James Kerney, editor and publisher of the Trenton Times Newspapers, for his kindness in reading the manuscript as also for affording him the benefit of his judgment and advice as a veteran author and publicist.

Many others in Trenton and elsewhere, too numerous to mention by name, have conferred favors for which he can only express his thanks in this general way.

H. S.

Trenton, New Jersey.

CONTENTS

	PAGE
<i>Preface</i>	vii
<i>Author's Note and Acknowledgments</i>	xi

PART I

John August Roebling, 1806-1869

<i>Chapter I: Muhlhausen in Thuringia. Family. Education and Early Ideals.</i>	3
<i>Chapter II: Immigrant, Colonist, and Pioneer Farmer</i>	16
<i>Chapter III: Early Ventures, 1837-1847</i>	42
<i>Chapter IV: Trenton, New Jersey, Gets a New Industry</i>	72
<i>Chapter V: Progress and Achievements</i>	93
<i>Chapter VI: The Niagara Falls and Other Notable Suspension Bridges, 1855-1867</i>	115
<i>Chapter VII: The Brooklyn Bridge Projected, 1867</i>	131

PART II

Washington Augustus Roebling, 1837-1926

<i>Chapter VIII: Reminiscences of Boyhood Days in Saxonburg</i>	155
<i>Chapter IX: The Man and His Training</i>	167
<i>Chapter X: Beginning a Professional Career</i>	176
<i>Chapter XI: Civil War Services</i>	188

CONTENTS

	PAGE
<i>Chapter XII: Lively Letters from the Field, 1861-1864</i>	198
<i>Chapter XIII: The Fruitful Years, 1865-1883. Brooklyn Bridge Completed, 1883</i>	233
<i>Chapter XIV: Long Retirement but No Idle Days</i>	260
<i>Chapter XV: Some "Obiter Dicta" of an Octogenarian Industrialist</i>	279

PART III

Ferdinand William, Charles Gustavus and the Third Generation

<i>Chapter XVI: Ferdinand William Roebling</i>	289
<i>Chapter XVII: Charles Gustavus Roebling</i>	310
<i>Chapter XVIII: An Inside View of a Great Industry (By Washington A. Roebling)</i>	330
<i>Chapter XIX: An Inside View of a Great Industry (continued)</i>	349
<i>Chapter XX: The Building of an Industrial Town— Roebling-on-the-Delaware</i>	367
<i>Chapter XXI: Improved Methods of Cable Making and Major Bridges of Recent Con- struction, 1903-1924</i>	374
<i>Chapter XXII: The Third Generation and After</i>	383
<i>Chapter XXIII: The Roeblings in the World War</i>	394
<i>Chapter XXIV: The Greatest Bridge of All—The George Washington Bridge over the Hudson River at New York</i>	399
<i>Index</i>	409

LIST OF ILLUSTRATIONS

John A. Roebling	<i>Frontispiece</i>
	FACING PAGE
Heinrich Wilhelm Roebling of Muhlhausen	8
Christine Friederike Roebling, Wife of Heinrich Wilhelm	8
Christine Friederike Roebling as a Bride	8
The Old Roebling House on the Untermarkt, Muhlhausen	8
The Roebling Ancestral Home at No. 2 Erfurterstrasse	9
The House in Muhlhausen where John A. Roebling Was Born	9
Spires of the Church of St. Blasius in Muhlhausen, where John A. Roebling Was Baptized	12
Ernst Wilhelm Roebling of Muhlhausen and His Family	12
Courtyard of the City Hall of Muhlhausen	13
Bronze Wreath Sent by Muhlhausen on the Occasion of the Unveiling of the Statue of John A. Roebling in Trenton	13
The Village of Saxonburg, Pennsylvania, in 1835, from an Old Print	38
The Shop in Saxonburg where the First Wire Rope Was Made, 1841	39
The Saxonburg Home of John A. Roebling, Built in 1832	39
The Naturalization Paper of John A. Roebling	<i>page 47</i>
The Portage over Mt. Pisgah	62
The Bridge across the Monongahela River at Pittsburgh, Built in 1846 by John A. Roebling	63

LIST OF ILLUSTRATIONS

	FACING PAGE
The Suspension Aqueduct at High Falls, Pennsylvania, Built by John A. Roebling	63
The Masthead of the <i>American Railroad Journal</i> , 1847, Containing John A. Roebling's Prophecy about the Pennsylvania Railroad	page 70
The Old Camden and Amboy Railroad Station, <i>circa</i> 1850	72
The Northwest Corner of Warren and State Streets, Trenton, <i>circa</i> 1850	72
The Old Trenton City Hall	73
The Mechanics and Manufacturers Bank of Trenton, <i>circa</i> 1850	73
The Original Trenton Plant of the Roeblings in 1849	page 76
The Roebling Residence and Factory in Trenton, from a Sketch Made by Washington A. Roebling in 1857	98
Charles Swan, for Many Years an Important Factor in the Roebling Enterprises	98
John A. Roebling's Tribute to His Wife, as Written in the Family Bible	99
The Niagara Falls Suspension Bridge, Completed in 1854	122
The Covington-Cincinnati Bridge, Completed in 1867	123
The Pittsburgh-Allegheny Bridge, Completed in 1860	123
The Bronze Statue of John August Roebling Erected in Cadwalader Park, Trenton, in 1908	142
Julius Riedel, a Waterloo Veteran, Uncle of the Roebling Brothers	143
Edmund Riedel, in Charge of the Roebling Rope Shop for Fifty-seven years	143
Colonel Washington A. Roebling	155
The Old Trenton Academy where Washington A. Roebling and His Brothers Attended School	page 170

LIST OF ILLUSTRATIONS

	FACING PAGE
Washington A. Roebling in 1861, as a Private in the Civil War	190
Washington A. Roebling in 1867, from a Photograph Taken at Muhlhausen	190
Mrs. Washington A. Roebling and Her Infant Son, John, at Muhlhausen in 1867	190
Colonel Washington A. Roebling, on Little Round Top, Gettysburg	191
The Famous Brooklyn Bridge	236
Emily Warren, First Wife of Washington A. Roebling	237
Wilhelm Hildenbrand, One of the Roebling Engineers Employed in Building the Brooklyn Bridge	237
President Arthur and His Party Crossing the Bridge	<i>page 251</i>
The Fireworks and Illuminations Celebrating the Opening of the Brooklyn Bridge	<i>page 253</i>
A Specimen of the Octogenarian Colonel Washington A. Roebling's Handwriting	<i>page 263</i>
The Second Mrs. Washington A. Roebling, née Cornelia Witsell	270
The Residence of Colonel Washington A. Roebling, Trenton	270
Ferdinand William Roebling, Sr.	289
Mrs. Ferdinand W. Roebling, Sr.	294
Residence of Ferdinand W. Roebling, Trenton	294
The Present City Hall of Trenton	295
The Trenton Free Public Library	295
Charles Gustavus Roebling	310
Charles G. Roebling as a Young Man, <i>circa 1875</i>	314
Mrs. Charles G. Roebling, née Sarah Ormsby	314

LIST OF ILLUSTRATIONS

	FACING PAGE
Washington Augustus Roebling, 3rd	315
Mrs. Richard McCall Cadwalader, née Emily Roebling	315
Mrs. Carrol Sargent Tyson, née Helen Roebling	318
Charles Roebling Tyson	318
The Charles G. Roebling Residence, Trenton	319
The "Upper Works" and Main Office of the John A. Roebling's Sons Company, Trenton	330
The "Lower Works," or Buckthorn Plant, of the Roebling Company	331
The Electro-Galvanizing Plant of the Roebling Company	348
The Plant and Village at Roebling, New Jersey	349
A Superintendent's House at Roebling, New Jersey	367
A Typical Street Scene in Roebling, New Jersey	367
The Williamsburg Bridge, Completed in 1903	380
The Manhattan Bridge, Completed in 1909	380
The Bear Mountain Bridge across the Hudson River, Completed in 1924	381
Karl Gustavus Roebling	384
Robert Clowry Roebling	385
Ferdinand William Roebling, Jr.	390
Mrs. Ferdinand W. Roebling, Jr., née Ruth Metcalf	392
"Lowlands," the Summer Home of Mr. and Mrs. Ferdi- nand W. Roebling, Jr., at Spring Lake, New Jersey	392
Joseph Metcalf Roebling	393
Ferdinand William Roebling, 3rd	393
The George Washington Bridge across the Hudson, the Latest Roebling Achievement, Completed in 1931	399

MEMOIR OF THE LIFE OF JOHN AUGUST ROEBLING
BY HIS SON, JOHN ROEBLING

PART I

JOHN AUGUST ROEBLING

1806-1869

CHAPTER I

MUHLHAUSEN IN THURINGIA. FAMILY. EDUCATION AND EARLY IDEALS

MUHLHAUSEN in Thuringia, where John A. Roebling was born in 1806, is an ancient walled town, dating its foundation from the ninth century. Never one of the important cities of Germany, nor conspicuous today even in its own province, Muhlhausen is only a comfortable old-fashioned Thuringian town with pleasant traditions and many quaint buildings. Yet there is much here to stimulate the interest and arouse the admiration of the discriminating visitor, who prefers age and quality to modernity and bigness. At the beginning of the nineteenth century, which is our starting-point, Muhlhausen was probably in appearance very much what it is today, not so populous, but otherwise the same in outward aspects. Jena, Erfurt, Weimar, and Gotha, its close neighbors, are all towns famous in history and literature; Jena with its ancient university; Erfurt with its memories of the great Luther; Weimar as the home of Goethe and Schiller; and Gotha with its grand ducal palace. Pilgrims flock to these places, drawn thither by the lure of their great traditions. Muhlhausen, on the other hand, is associated with no world-famous men or great historical events, and is, therefore, commonly overlooked by the average tourist who has only time to touch the high spots in his limited itinerary.

Someone has described Muhlhausen in the words of Tennyson as:

THE ROEBLINGS

“A sleepy town, where under the same wheel
The same old rut is deepened year by year.”

Probably this characterization is untrue, as it is certainly unkind. Doubtless the modern Muhlhausen is as progressive as it has any need to be, and has today its “Main Street,” and its Rotary group of “go-getters.” But in the early days of the last century no one thought it a virtue to be progressive; indeed, population and wealth were a decided detriment to a place in those unhappy days when the victorious armies of the great Napoleon were laying all Germany under tribute.

A local historian writing of those times thus sums up the conditions in Muhlhausen of which the following passage is a free rendering of the German:

MUHLHAUSEN IN THE NAPOLEONIC WARS

“During these troublous times troops of various nationalities—French, Russian, Swedish, Austrian, Prussian, and Westphalian—marched through Muhlhausen and exacted heavy tributes, which could only be raised with great difficulty, and by taxing the private property of its citizens. Yet with the loss there was also gain, and the war brought a certain degree of prosperity to merchants, tradesmen, and artisans who furnished certain war supplies and also had the opportunity to make purchases of the invaders at favorable prices. Thus the Russian Cossacks occasionally sold horses, which they had stolen, at prices far below their true value. The citizens of Muhlhausen took an active interest in the war and volunteers were many. In the spring of 1815 in the last campaign against Napoleon which culminated at Waterloo, Muhlhausen furnished five hundred men, which considering that the inhabitants of the

THE ROEBLING ANCESTRY

town at that time were less than ten thousand, and that no compulsory military duty existed, was a goodly proportion."

THE ROEBLING ANCESTRY

It was during this period of storm and stress, only a few months before the Battle of Jena was fought, that on June 12, 1806, there was born in Muhlhausen to a worthy burgher, one Christoph Polycarpus Roebing, and his good wife, Friederike Dorothea, née Mueller, their third son and fifth child whom they caused to be baptized by the name of Johann August. The name was a common enough one in the family tradition, but not so the cognomen Polycarpus of the elder Roebing, which does not occur previously in the long genealogy of the family running back to 1560. The name is an intriguing one and, to say the least, unusual in Germany or elsewhere. To be sure there was once a Saint by that name, as those informed in early Church history will recall, Blessed Polycarp, Bishop of Smyrna, who flourished during the second century and is supposed to have been a disciple of St. John of Ephesus. Ecclesiastical history records that this Polycarp suffered martyrdom by burning, in his extreme old age. Probably there must have been some of the Roebing kin with hagiological interests, who was responsible for this unusual name, or perhaps some good Lutheran pastor and a friend of the family, who admired the Saint, suggested the name as being distinctive, which it certainly is.

Christoph Polycarpus Roebing is described in the official records as a tobacco manufacturer,—“fabrikant” is the word used, which would appear to mean that he prepared his own stock, doubtless with the help of assistants, and disposed of his wares at wholesale, as well as retail. However that may have been, Polycarpus seems to have been a substantial citizen, belonging to a family highly respected in the community ever

THE ROEBLINGS

since the first representative of that name, Hanns Jacobus Roebing, came to Muhlhausen from Tennstedt in 1670, and was duly admitted to citizenship the following year. Through a careful research, made from official sources by Dr. Rudolph Heinrich Roebing, of a collateral branch of the family, at present living in Hagen, Westphalia, and an official of the High Court of that district, the Roebing line of ancestry is traced back to a Nicholas Roebing, or rather Rebeling, as the name was then spelled, born in 1560, who is described as a "wool-weaver, market-master, public weigher and builder of the City Council" of Tennstedt in Thuringia. His son, Jacobus, in the direct line of the American Roebings, seems to have been treasurer of the city of Tennstedt. He in turn had a son, Hanns Jacobus, the one referred to above as the first to make his home in Muhlhausen. His son Jacobus Philip was the father of Hermann Christian Roebing, who was the father of Polycarpus and hence the grandfather of Johann August.

Hermann Christian seems to have been a man of some distinction in Muhlhausen. He was born in 1721. In 1756 he bought the ancestral home, a building erected in 1587. From 1777 to 1789 he was a member of the External Council and from 1790 up to the time of his death in 1801 was councillor in Muhlhausen. His second wife, Maria Elizabetha Weymar, whom he married May 2, 1755, was the grandmother, as he was the grandfather, of Johann August Roebing, and thus the direct ancestors of the American Roebings.

There have been preserved some verses, written in honor of their marriage by a local versifier of those days, evidently read on the occasion, and doubtless much enjoyed by the assembled company.

The following is a free translation of a few lines of the
EPITHALAMIUM:

THE ROEBLING ANCESTRY

A succulent capon, or a nice fat pullet
Are delicious food that everyone enjoys.
A goblet of wine, and a bride filled with the fire of love
Go together, as do sauerkraut and pork.

When the young Roebbling came to buy "fresh goods"
He energetically proceeded to the place
Where store there was of choicest merchandise.
Cupid, god of love, said "Look!
This one hath beautiful yellow hair,
Even more beautiful than Dido's;
A comely face she hath, eyes of crystal brightness;"—
These straightway won him, and he loved her well.

I call her "That beautiful one, with rosy cheeks,
And in whose heart is nought of envy and of jealousy."
Sweet she is, sweet as is the flavor of blue grapes,
Which, as Bacchus avereth, is of tempting strength.

Their hands were clasped;
Young Roebbling ardent was,
And his decision quickly made.
"Truly, through good fortune, thou hast found
A lovely one, who hateth falsehood and deceit;
Your hearts are joined in amity—love well."

HEINRICH WILHELM, THE "RICH ROEBLING"

Before leaving the family record it may be stated that an elder son of Hermann Christian Roebbling, Heinrich Wilhelm, and thus a brother of Polycarpus, was a highly successful man. He was born in 1756 and lived until 1841. He was a wholesale grocery merchant with wide connections, doing an extensive business in grain, seeds, glue, etc., not only in Germany but also

THE ROEBLINGS

trading in England and America as well. He amassed a fortune of some 500,000 thalers and was popularly known as the "rich Roebbling." He was a public-spirited citizen and mainly at his own cost equipped the famous "Corps Luetzaw" which was recruited in Muhlhausen. He became the proprietor of the estates of the "Felchts" and also acquired the ancient lands and buildings of the Benedictine Monastery "Zella" near Muhlhausen, which he occupied as his country home. His city mansion was on the Untermarkt.

In an obituary notice of him printed in a local newspaper in 1841, a high tribute was paid to him as an honorable business man, a patriotic citizen and philanthropist. In 1836, the king conferred upon him the House Order of the Red Eagle, fourth class. He married Christine Friederike Meyer, born in Muhlhausen, May 14, 1774, died May 5, 1844. The couple had two sons and one daughter, Johanna, who intermarried with the well known Lutteroth family of Hamburg, of whom the present head is Dr. Jur. Ascan W. Lutteroth, a distinguished civil official of the Prussian government.

Another brother of Polycarpus, Ernst Adolph, was master of the Clothmakers' and Sergemakers' Guild of Muhlhausen and also a senator. Relatives of the Roebbling family are still living in Muhlhausen. These are descendants of Ernst Wilhelm Roebbling, the cousin and intimate friend of John A. Roebbling. A great-grandson is at present attending the Royal Polytechnic School at Berlin, where John A. Roebbling himself was educated.

THE PARENTS OF JOHANN AUGUST ROEBLING

Christoph Polycarpus, the father of Johann August, was born July 24, 1770, and died January 24, 1847. His wife, Friederike Dorothea, was born December 8, 1770, and died



*Heinrich Wilhelm Roebing, of Muhlhausen—"the Rich Roebing,"
Uncle of John A. Roebing*



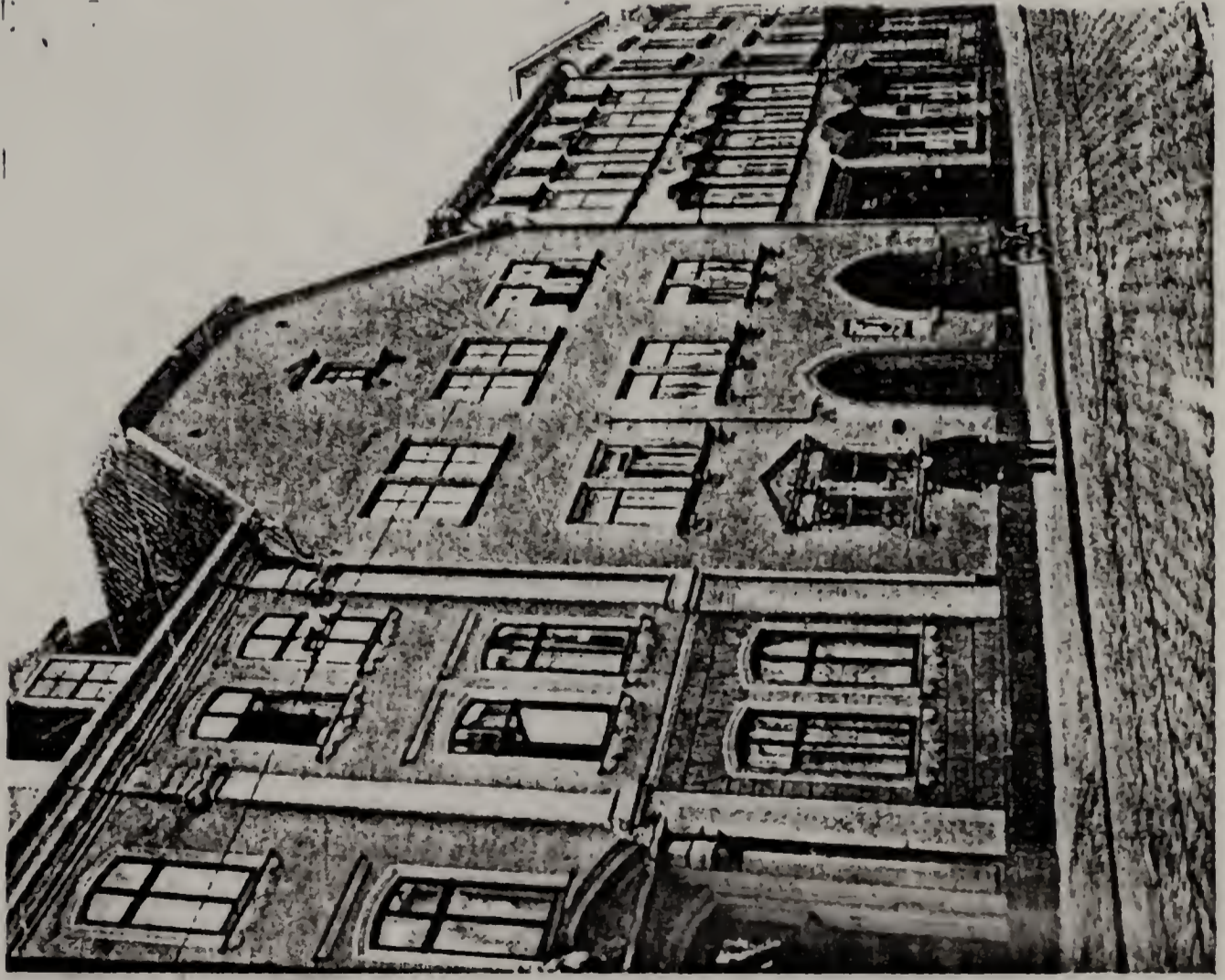
*Christine Friederike Roebing, Wife
of Heinrich Wilhelm Roebing*



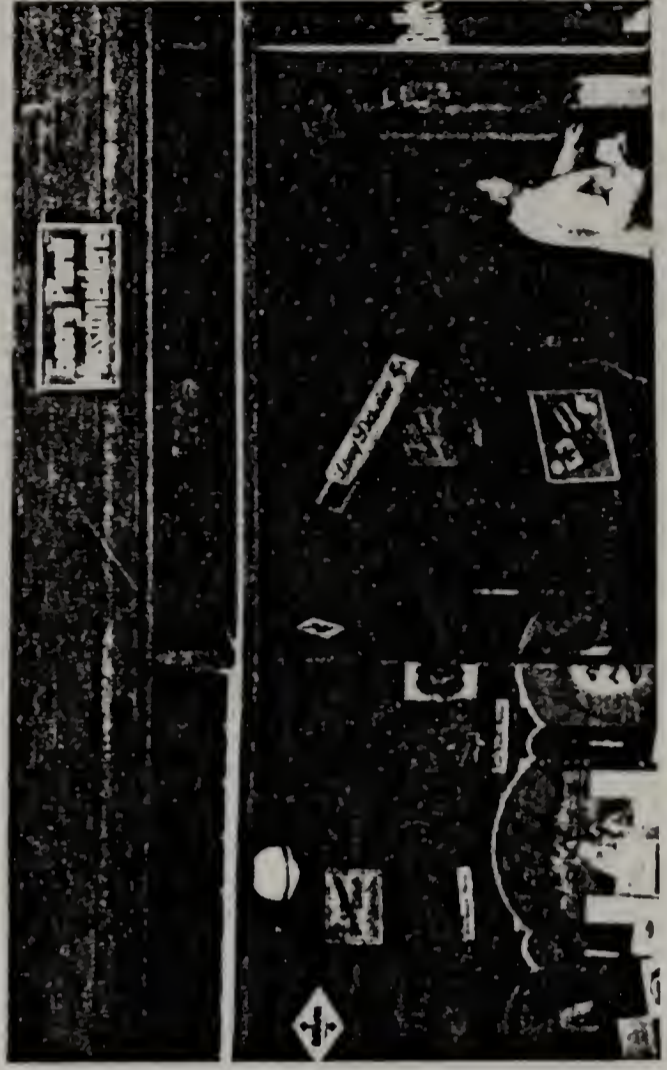
*Christine Friederike Roebing as a
Bride*



*The Old Roebing House on the
Untermarkt, Muhlhausen*



The Roebing Ancestral Home at No. 2 Erfurterstrasse, Muhlhausen, Built in 1587



The House in Muhlhausen where John A. Roebing Was Born, Marked by the Bronze Tablet Shown in the Picture

Fig. 1. The structure of the polymer film.



Fig. 2. The structure of the polymer film.



THE ROEBLING ANCESTRY

August 5, 1832. They were married April 23, 1798. The first child, Friederike Amalia, died in infancy in 1801. Another daughter, also named Friederike Amalia, was born October 27, 1802, and later was married to a merchant, Carl Meissner by name. After the death of her husband she came to America in 1851 with her six sons and one daughter, and descendants of hers are living in this country today.

The three sons of Polycarpus and Friederike Dorothea were respectively Hermann Christian, born July 6, 1800, Karl Friederich, born July 13, 1804, and the youngest, Johann August, with whom we are concerned. Hermann Christian remained at home, succeeded his father in the tobacco business, and died in Muhlhausen in 1859. Karl Friederich accompanied his brother John to America in 1831, and died in Saxonburg, Pennsylvania, in 1837.

A family tradition portrays the father as a phlegmatic, easy-going man, unambitious either for himself or his children, content to pass his days in the familiar surroundings of his native town, enjoying its excellent beer and withal an inveterate smoker of his own tobacco. One can easily picture Polycarpus sitting at ease in his cosy little shop, chatting familiarly with his cronies and favored customers, and perhaps a little inclined to be annoyed when the calls of business broke in upon his leisure, and goaded him to unwonted and undesired activities.

The mother, on the other hand, was of an entirely different type, alert, determined and ambitious. Not for her this "pent-up Utica" of a dull and unprogressive Muhlhausen. She dreamed dreams and cherished visions if not for herself, at least for her children. Doubtless she had learned early in her married life the hopelessness of attempting to infuse a measure of her own vital energy, mental and physical, into the sluggish breast of her unresponsive and unadventurous mate. If her

THE ROEBLINGS

good man was content with things as they were and demanded nothing more from life than to be permitted to drift along in the accustomed channels, her ardent nature cried out for progress and achievement. If she rebelled against fate, it was not so much of her own personal lot as a middle-class hausfrau occupied with humble domestic cares that she was thinking, as of her children, particularly of her sons. Was there to be no career for them except to follow in the footsteps of their unambitious father and to spend their lives in the undistinguished pursuits of a petty local tradesman? Perhaps, like a wise woman, she kept these dreams and longings to herself and did not reveal them even to her husband or her friends, at least until she discovered in her youngest son endowments and qualities which were the replica of her own. Even strangers noted the quick intelligence and nervous energy of the growing lad and saw in him the latent possibilities of worthy achievement, if only opportunities were afforded him.

The mother's eager response to this stimulus is thus summed up by one familiar with the family tradition.

"Thenceforth ambition had one goal, life but one object—the education of her boy; through him she would achieve; through him she would fulfil her destiny. Work was redoubled—it became a sacrament. Economies were multiplied—they had become a rosary, for every pfennig saved was a prayer answered. The members of the family were incited to ceaseless effort, while she, the mother, brooded and safeguarded the fruits of that effort. Her executive faculties developed with this exercise and she managed everybody and everything."

EDUCATION OF JOHN A. ROEBLING

Thus it came about that the talented youngest son got the opportunity for self-development through an intensive educa-

EDUCATION AND EARLY IDEALS

tion which his two elder brothers either did not desire, or for which they did not possess the talents. John, henceforth to give him his name in Anglicized form, received his preliminary education as did other youths of his town in the Muhlhausen public schools, then, in natural course, he entered the City Gymnasium, an institution about equivalent to our high school. As he had already determined to follow the engineering profession it was necessary that he should receive a specialized training in mathematics before he could qualify for entrance to the famous Polytechnic Institute in Berlin.

He seems for a period to have been aided in his studies, while in the Gymnasium, by one Ludwig Lies, a private tutor, and afterward by a cousin. This Lies subsequently became Roeb-ling's most intimate friend. He was at that time the most advanced student in the Gymnasium, where he was preparing himself for a university career, but instead finally devoted himself to the printing business. Young Roeb-ling joined him in paying a visit to his parents at Eschwege, and while there, under Lies' direction, prepared himself for the "builders' examination." Roeb-ling took advantage of his residence in Eschwege to draw a sketch of the city which subsequently appeared with other lithographic views in the *Chronicle of Eschwege* written by Hochaut.

It was under Doctor Ephraim Solomon Unger, the famous mathematician who had been a professor in the University of Erfurt, that Roeb-ling received his instruction in the higher mathematics. After the University was closed in 1820 Dr. Unger founded a private institute in Erfurt which Roeb-ling attended. His proficiency in these studies marked him out as a favorite pupil of the celebrated professor and a real friendship and intimacy grew up between the two. In 1833 Dr. Unger changed his private institute into a Realschule, from

THE ROEBLINGS

which the modern Gymnasium of Erfurt afterwards emerged.

While at Erfurt a strong friendship grew up between Roeb-ling and Friederich August Stueler, who became later the court architect of Friederich Wilhelm IV, and successor of the famous Schinkel. Stueler was six years older than Roeb-ling, but their lives were closely associated during the time both spent at Erfurt. Upon leaving Erfurt Stueler spent several years in practical work and when he entered the Academy of Architecture at Berlin he found Roeb-ling at the Polytechnic Institute, which existed there beside the Academy, and the intimacy between the two was renewed. They worked together in close fellowship in architecture and other kindred studies. Roeb-ling specialized in sub-construction (Tiefbau) and more especially in bridge-building under J. F. W. Dietleyn and dike construction under the celebrated Professor J. A. Eytelwein. In addition he took special courses in modern languages at the University of Berlin and attended assiduously the lectures of the world-famous philosopher, Hegel.

It is a tradition in the family that Roeb-ling was Hegel's favorite pupil and this receives strong confirmation in the fact that he seems to have absorbed the spirit of the Hegelian philosophy and all through his after life spoke with pride of his association with the master.

In a short character sketch written by a friend of the Roeb-ling family, the dominant influence of the Hegelian philosophy in Roeb-ling's intellectual life is referred to:

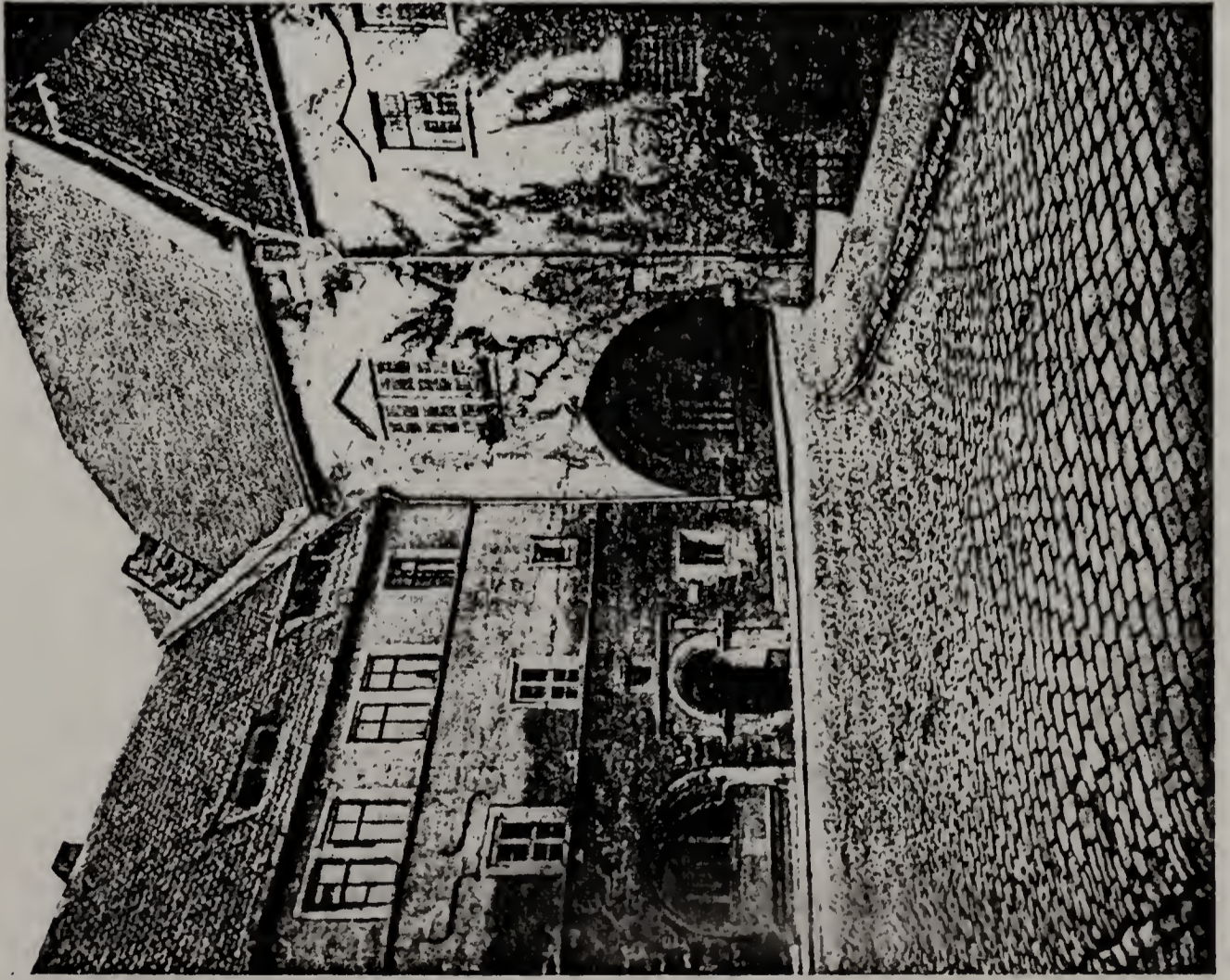
"It is impossible to study him [Hegel] diligently and not be profoundly influenced by his teachings, and for a youth like John A. Roeb-ling to have been brought into intimate contact with his dominating personality, was at once a privilege and a calamity. A privilege, because it opened the boy's eyes to the spiritual reality back of the 'change and decay' of material



Spires of the Church of St. Blasius in Muhlhausen, where John A. Roebling Was Baptized and of Which John Sebastian Bach Was Once the Organist



Ernst Wilhelm Roebling of Muhlhausen and His Family, Cousin and Intimate Friend of John August Roebling



Courtyard of the City Hall of Muhlhause



*Bronze Wreath Sent by Muhlhause on the Occasion of the
Unveiling of the Statue of John A. Roebling
in Trenton, 1908*

EDUCATION AND EARLY IDEALS

phenomena. . . . A privilege, because he was taught to think independently, and rely upon the validity of his own conclusions. It was a calamity, because it begat a pride and arrogance of opinion and a frigid intellectuality that came near to putting the heart of him into cold storage. . . . Nothing that he [Hegel] has said, by the manner of his saying it, makes anyone the braver for reading it, or the better for remembering it. The philosopher has almost, if not altogether, eaten out the man. And John Roebling was the favorite of this prodigy. . . . Hegel was a metaphysician, so was John Roebling—metaphysics was his dissipation. The time others spent in amusements, the reading of polite literature, or impolite newspapers, John Roebling devoted to metaphysics. His son has a manuscript volume of thousands of pages written by his father, called 'Roebling's Theory of the Universe.' I have not read this book—Heaven forbid that I should ever be asked to do so. . . . Hegel was an idealist, so was John Roebling, who scouted the atomic theory. His son, Washington, had studied the chemistry of Dalton and attempted to combat his father's arguments: 'But,' says he, 'Father would damn my atoms—and with loud and angry vociferation. This was hardly a pious way to resolve matter into spirit, but it was strictly Hegelian.' ”

ROEBLING'S EARLY INTEREST IN SUSPENSION BRIDGES

When he was twenty years old Roebling took his first examination in the Royal Polytechnic Institute of Berlin and he then worked three years for the Prussian government as an assistant in building roads in Westphalia. Bridge construction was his favorite study and his ambition was to create something along new lines. He had heard of suspension bridges but as yet had seen none. When he learned of one which had been recently built, held in suspension by chains, for the day of

THE ROEBLINGS

wire-cable bridges had not yet arrived, over the River Regnitz in Bamberg, he visited the place for the purpose of inspecting this "miracle bridge," for as such it was known. He made a careful examination of the construction principles and carried away with him a neatly drawn plan with a careful estimate of its cost and presented the study for his state examination work. He was ambitious to do something along original lines but found himself thwarted at every turn. Red-tape and official inertia blocked his way. Finally he became convinced that Germany offered him no opportunities of achievement and thus his thoughts were turned towards an alternative—immigration to America.

YOUNG ROEBLING AN ARDENT LIBERAL

There was at that time in Muhlhausen, as in other centers, a band of ardent young liberals who chafed under the autocratic régime which prevailed in the Germany of that era, and who felt that political reform was a hopeless task under the conditions then obtaining.

A local historian referring to the defiant spirit of the age as it revealed itself in youthful minds, says:

"The generation that was born in Muhlhausen around the 1800's brought a new world with it. As soon as it became influential (about 1830) the old humdrum of the 'Reichsstadt,' which can mean, neither life nor death, disappears and the Renaissance generation which possesses the spiritual value of the new century, the Classicism, the Romance, the Liberalism and the National Thought expresses itself bravely."

The same author proceeds to mention some half-dozen of the young men of Muhlhausen who were among the local representatives of the new Germany, and includes John A. Roebling in the group.

EDUCATION AND EARLY IDEALS

That Muhlhausen has not been unmindful of the fame of its illustrious son is evidenced from the fact that on July 12, 1876, a bronze bas-relief of the bust of John A. Roebling was affixed to the façade of the house where he was born, and that since July 1883 the name of the former "Goermarstrasse," where the house stands, was changed in his honor to "Roeblingstrasse." Also when a statue of the famous engineer was erected in Cadwalader Park, Trenton, in 1908, the municipality sent a bronze wreath as a tribute to his memory.

John A. Roebling himself was not forgetful of his native town. In 1868, after his son Washington had returned home from a sojourn in Europe whither he went in 1867 to study the principles of caisson construction in preparation for building the Brooklyn Bridge, the elder Roebling sent to the Mayor of Muhlhausen the sum of five hundred dollars for the poor of the city as a token of his gratitude for the safe return of his son, his wife, and their infant son, his namesake, who was born in Muhlhausen during the stay of his parents in that city.

CHAPTER II

IMMIGRANT, COLONIST, AND PIONEER FARMER

Founds the Village of Saxonburg in Western Pennsylvania, 1831

A NOTABLE rise in the tide of German immigration to the United States set in during the decade 1831-1840, due to various contributory causes, political, social, and economic. During this period a total of over one hundred and fifty thousand persons of German blood landed on these shores. Previous to this time the immigration had been spasmodic; individuals with the adventurous spirit came as such, but not as representing any specific movement. From the end of the first quarter of the last century, following the close of the Napoleonic Wars, a systematic exodus first began, which included, besides the peasant and farmer element, not a few men of superior education, and even of rank, who were impoverished as the result of the constant wars and who hoped to resuscitate their fallen fortunes by availing themselves of the opportunities afforded in a new and still unsettled country where it was easy to acquire land, and taxes were an inconsequential factor.

The immigrating farmers, accustomed in their own country to hard work on the soil, found the conditions here favorable beyond their hopes and in a short time succeeded in establishing themselves on the cheap land and reaping the due reward of their industry and thrift. The upper-class element, on the other hand, who were known as "Latin farmers" owing to the fact that they had attended the gymnasia in their native land and thus had received a cultural education, which included

IMMIGRANT, COLONIST, AND PIONEER FARMER

Latin and Greek, found conditions here peculiarly hard. Most of them were thoroughly unfitted for the laborious life of a working farmer, and possessing no useful trade to fall back upon, eked out a wretched existence. A few were able to find employment in clerical positions or as musicians and teachers of languages, but for the most part they became mere drifters, and finally, after a hard struggle with poverty, many were compelled to settle down to the life of farm laborers, working in that humble capacity perhaps for some prosperous proprietor of their own race.

IMMIGRATION OF SKILLED MECHANICS AND TRAINED TECHNICIANS

About this time also a new class of immigrants began to arrive, comprising the skilled mechanics, as well as a contingent of those trained in the famous polytechnic schools of Germany. Both of these had found conditions prevailing in their own country difficult, if not insupportable. It was the beginning of the new industrial era, when machinery was supplanting the old handicrafts, and many artisans could not find employment under the new methods. In the case of qualified graduates of the polytechnic schools there were not enough jobs at home to go around, and, moreover, most of the work to be done in their line was under the government, for which the remuneration was inadequate and the restrictions galling to ambitious minds.

In our own country, where industrial and transportation development was just beginning, there was then a great scarcity of trained workers along mechanical lines, as also of men qualified by education and experience to act as superintendents and engineers. As these facts became known in Germany not a

THE ROEBLINGS

few of this class were led to take advantage of the opportunities awaiting them and hastened, as individuals or in groups, to make their way hither. Germany was even then the land par excellence of mechanical ingenuity and expert knowledge, and nowhere in the world were these elements more needed than in the America of that era. The country had abundant resources which awaited development, but native scientific knowledge was unavailable. The problems of transportation, of mining, of manufacturing, demanded constructive minds and mechanical skill and America could not itself supply the lack, for technical schools where students could be trained had then no existence.

Albert Bernhardt Faust in his book *The German Element in the United States* points out that it was men of German birth who answered this call and won their proportionate rewards:

“In the constructive work of our country, involving problems of magnitude never before presented, the German element may be said to have had a monopoly. The case is not difficult to see. The technical schools of Germany were very efficient and sent out well trained men, long before any similar schools existed in the United States. Being the most capable the graduates of the German schools of technology received the most responsible positions, won in the competitions for the best engineering work offered in the United States, and their monopoly continued for the greater part of the nineteenth century, until our schools became efficient.

“The greatest advances made in the history of bridge-building in the United States were produced by two Germans, John A. Roebling, the inventor of the modern suspension bridge, and by Charles C. Schneider, constructor of the successful cantilever bridge.”

IMMIGRANT, COLONIST, AND PIONEER FARMER

POLITICAL AND ECONOMIC CONDITIONS IN GERMANY STIMULATE IMMIGRATION

Another, and perhaps predominating factor leading to the immigration of educated men early in the 1830's, is found in the political conditions prevailing in the Germany of that period. As the result of the July Revolution of 1830, the frightened rulers of the German States were then busy tightening their hold upon the universities, attempting to stifle independence of thought and liberty of speech and through high taxation and personal restrictions of the most obnoxious sort, were crushing political freedom and curbing individual initiative. There were many among the younger educated class of that day who found the conditions intolerable and sought a ready remedy by forsaking a land where they were not suffered to breathe freely, for one which held out the promise of individual and political freedom, with unbounded opportunities for personal advancement.

Animated by these considerations immigration received a fresh stimulus. Individuals came singly and colonizing groups were organized in all parts of Germany. Most of the peasant or farmer type, including the "Latin farmers," found their way to the fertile valleys of the Ohio and Mississippi or the Northwest. Only a few settled in the cotton-growing belt, for the institution of slavery was repugnant to the majority. The skilled mechanics and the educated technicians naturally remained in the East or near the East, where their services were most needed by industry and their skill and talents were welcomed and liberally rewarded.

John A. Roebling, though a qualified engineer, chose to begin his career in this country as a land developer and pioneer farmer, though he only continued as such for a brief period,

THE ROEBLINGS

gravitating, as was inevitable in the case of a man of his talents and education, into a sphere more suitable to his disposition and capacities.

As outlined above an immigration movement to America in the 1830's was pervading all Germany and the infection soon reached Muhlhausen. To the general political unrest which prevailed everywhere must be added the special economic conditions which obtained in Muhlhausen and vicinity. Opportunities for earning a living were limited in the case of tenant-farmers. The naturally poor soil and a series of bad crops had reduced them almost to a state of peonage. Mechanics and tradesmen were suffering from the general business stagnation and educated men without capital could find small employment for their energies. Wealthy merchants and speculators were the only ones who managed to hold their own and perhaps attain a measure of prosperity. Thus the time was ripe for a popular exodus and multitudes were contemplating the prospect of altering their conditions by a removal to another country, and naturally it was America which captured their imagination.

JOHN A. ROEBLING ORGANIZES A PARTY OF COLONISTS

Several immigrants returning on a visit to their homes in Muhlhausen, after a sojourn in the United States, painted a glowing picture of the advantages and opportunities which awaited colonists in that free and spacious land. Societies of colonists were organized, leaders were chosen, and money subscribed for the purchase of land. Foremost among those locally fired with the pioneer spirit were John A. Roebling and his brother Karl, who constituted themselves an advance guard to go out to America, look over the country and purchase suitable

IMMIGRANT, COLONIST, AND PIONEER FARMER

lands in the interest of their friends and others who were then or might afterwards be associated in the enterprise.

According to his own words, Roebling was animated by no mere spirit of adventure, but his action was rather a carefully considered one. He looked for another homeland where conditions were politically freer and the opportunities for advancement less restricted. It was no spirit of pique, or despite for his native land, that influenced his decision, but mainly considerations of a personal and practical sort. As the government of that day was disposed to frown upon the immigration of the better elements, including men trained in technical pursuits, many obstacles were placed in the way of organizing his party of colonists. An engineer, Etzler by name, returning to Muhlhausen from America, with whom Roebling had formed an intimate association, was imprisoned by the government on account of the propaganda for which he was responsible, and the members of the colonizing party which he had formed were placed under police surveillance.

In addressing his letters to the special group in which he was interested Roebling observes the utmost caution of expression. He refrains from commenting upon political matters and refers to such subjects by some vague expression as, "You know what I mean."

Many manuscript letters written to John Roebling, both before and after his departure to America, have been preserved, but their full interpretation would require his letters to them, which unfortunately are not available. Something of interest, however, may be gleaned from this one-sided correspondence. It would appear from these letters, most of which have no dates, that the organization of this colony was a more or less tentative one. Some had already subscribed money to buy land, others were prepared to do so upon favorable reports from the

THE ROEBLINGS

two brothers. One list gives the names of some forty-five persons who had practically made up their minds to join Roeb-ling's colonization scheme, then or later. Most of these were farmers or mechanics with a few clerks and professional men, and all were inhabitants of Muhlhausen and adjacent towns and villages. Some fourteen of these seem to have paid over their money in cash and others had promised to do so at an early date. In some cases the subscribers had indicated that they would be delayed in their departure for a year or two. The total amount subscribed in cash and promises is given at 13,265.00, but whether dollars, thalers or ducats, does not seem to be plain, but probably dollars. The list contains the name of Ferdinand Baehr, who subsequently became one of the early colonists of Saxonburg. The name of Ernst Herting, also a colonist, is included; his daughter afterwards became the wife of John A. Roeb-ling. According to the diary of his voyage kept by John A. Roeb-ling there appear to have sailed with the Roeb-ling brothers on the ship *August Eduard* some sixty to seventy persons who were members of their party, but how many of these subsequently accompanied them to Saxonburg and became permanent settlers there it is impossible to say.

Shortly before the Roeb-ling brothers left Germany for the United States under date April 24, 1831, they made a contract with one August Grabe, a mechanic living in Kaysershagen near Muhlhausen in accordance with which the Roeb-lings agreed to pay the passage over seas for Grabe and his family, the latter binding himself and his family to work for the Roeb-lings during a period of three years after reaching the United States. The contract is framed along the usual "redemption-er" lines and is here printed in full as an interesting document of a century ago. Whether the contract was actually carried out or not it is impossible to say, though probably not, for the name

IMMIGRANT, COLONIST, AND PIONEER FARMER

of Grabe does not appear in the list of Saxonburg colonists as given by Colonel Roebeling in his *Early History of Saxonburg*.

CONTRACT

The undersigned brothers, Frederic Charles Roebeling and John Augustus Roebeling of Muhlhausen in Thuringen in Germany, who purpose to make a settlement with a society of Germans in some of the southern parts of the United States of North America, for cultivating land, and to depart to that effect in the spring of this year, make with the mechanic and workman Augustus Grabe from Kaysershagen near Muhlhausen the following agreement:

(1) Aforesaid Roebelings pay the passage over sea for said Grabe and his family, except his eldest daughter, and provide for all their necessaries during the passage.

(2) In return aforesaid Grabe binds himself with his family, except his eldest daughter, consisting of his wife to accompany said Roebelings to America and to work there for them in any manner that may lawfully be required, viz.: aforesaid Grabe with his wife for three years, beginning with the day of landing in America; with respect to his other aforesaid children until the day when they become of age, that is to say: the sons to twenty-one years and the daughters to eighteen.

(3) Aforesaid Grabe with his family has to submit to all regulations made by the society, during the voyage, to which said Roebelings are belonging.

(4) After having arrived on the place of settlement in America and the most necessary buildings being finished, there shall be put into the hands of said Grabe a piece of land of such an extent as he and his children are able to cultivate, according to an acreage calculation by day's work, and in order to clear, fence and cultivate it in such a manner, as said Roebelings shall direct.

(5) Said Grabe, his wife and children are to receive from said Roebelings, besides their board, lodging and, in case of sickness, also attendance, during these three years for their wages every year the eighth part of the produce raised and prepared for sale, by him and his children. However, his wife has to attend exclusively to the housekeeping business for said Roebelings and if there is time enough may assist her man while the children assist their father. In consideration of these wages said Grabe has to provide for the clothing for himself, his wife and his children, without further compensation.

THE ROEBLINGS

(6) In cases where said Grabe is occupied by the direction of said Roebblings in some other business not belonging to the cultivation of his land, he is either to receive the eighth part of the value of such work or he is to have a substitute for his cultivation of land during the time he is occupied in such other business. The children of said Grabe are bound, during these three years, to do also occasionally small services at the demand of said Roebblings.

(7) As it is probable in the first year that a smaller area of land can be cultivated, than thereafter, said Grabe has to continue with improvements of land insofar as he is able the rest of these three years.

(8) Said Grabe is permitted to keep a stock of cattle and other domestic animals in pasture for his own use, during these three years.

(9) At the end of the three years the children of said Grabe and his wife are to enter into the immediate service and under the care of said Roebblings for the rest of their service, during which time said Roebblings provide for all the necessaries of the children. During their service, including the first three years, said Roebblings provide also for their necessary education, both in the German and English language, as well as the colony will afford. At the end of their service they shall be entitled to those benefits which the law of the United States directs.

(10) During their service said Grabe and his family are not permitted the customary use of strong spirits.

(11) If said Grabe with his family fulfils conscientiously all articles of this lawful agreement and behaves himself in general honestly and faithfully during the terms of his service, he shall have at the end of these three years a piece of land in lease on advantageous conditions.

(12) This contract in the German language together with this translation is to remain in the hands of said Roebblings and a copy in the German language is to be put into the hands of said Grabe.

At the arrival in America all these three pieces are to be confirmed by a lawful authority.

In confirmation of this agreement the contracting parties have subscribed their names.

Muhlhausen the twenty-fourth of April in the year eighteen hundred and thirty-one.

(Signed)

Witnesses

Y. A. ETZLER
W. HACKSTEIN
B. RATHE

(Signed)

J. A. ROEBLING
pr: CARL ROEBLING
AUGUSTUS GRABE
XXX (*Mark of his wife*)

IMMIGRANT, COLONIST, AND PIONEER FARMER

FINANCING THE COLONIZATION ENTERPRISE

It does not appear that the Roebling brothers originally put up any of their own money, if they had any, to finance the expedition or to buy the land. They were promoters rather than capitalists, and promoters have seldom the inclination or the resources to invest largely in the projects which they advocate and develop, but depend rather for their compensation upon commissions as agents and managers. It is certain when the Roeblings went to America they carried a substantial sum with them, said to be in the neighborhood of \$6,000. It is surmised in some quarters that this sum represented their share of the family patrimony, but this would seem to be doubtful. Their parents were then living and there was another son and a daughter at home to be provided for. The indications are that, while the family were in comfortable circumstances, there was no cash surplus of that amount, a small fortune in those days, available to hand over to the other sons. It would appear also from the correspondence that there was an arrangement with their fellow colonists to the effect that the brothers were to have as their commission from ten to twenty per cent of the acreage which they purchased with the money which had been placed in their hands.

BOOKS CONSULTED RELATING TO AMERICA

Where the settlement should be made was a matter that was undecided and was left to the judgment of the brothers, particularly of John, who, though the younger of the two men, was evidently the leader and trusted as the more capable business man. It is plain also even before their departure that the matter of choosing a locality for settlement had been given careful thought. All books relating to America then available in Ger-

THE ROEBLINGS

many appear to have been consulted. Florida seems at first to have been favorably considered. There is a letter from the Geographical Institute at Weimar referring to a volume published by that body relating to America, containing 1212 pages. "You will find," says the writer, "a list of everything that belongs to America therein."

There was another book which appears to have been in the process of publication under the title "Opportunities in the United States for Emigrants and Plans how to Settle There."

A correspondent from Hamburg writes August 17, 1830: "I note with great interest that an emigration party is getting ready to leave for America to settle in the southern part of the United States of North America. As soon as I receive copies of the printed plans it will be a pleasure to me to distribute them here. Regarding your request for information concerning the unsold land in North America, I refer you to the *Columbus* of 1827." (A publication evidently designed for immigrants.) Then follow some statistics giving the acreage of government lands available for purchasers.

LETTERS TO ROEBLING FROM FRIENDS

Many of the letters are merely requests for information or replies to letters from Roebbling urging the advisability of immigrating and setting forth the conditions and prospects in the new country. One letter from a friend in Leipzig written before Roebbling's departure, February 5, 1831, approves of the step he was contemplating:

"You are quite right about going to America if you have a good offer there. We won't have peace here for a long time. I am only surprised at your wanting to leave Prussia and with it the opportunity it offers to construction men of your type. Inasmuch as you are so far advanced in this respect, it is time you

IMMIGRANT, COLONIST, AND PIONEER FARMER

should harvest the fruit of your labors. However, with your brilliant mind you can easily adjust yourself to any science or art and, no doubt, you will in many ways be superior to the people with whom you will deal in America."

A letter, no date, but evidently written before the Roebblings' departure, from Ferdinand Baehr, who is referred to previously, bids the brothers an affectionate farewell:

"Now dear friends, a last farewell! You have done well. Your names will be glorified by your children's children. You should be highly praised and honored for your brave hearts and the spirit of friendship which you possess. I await with longing the hour which will bring us together again."

Here is a letter, evidently from a relative, since he refers to "we three Roebblings." Apparently, he has been acting as an agent in the interest of the group of Roebbling-colonists, and has been besieged by a crowd of eager applicants. He gloats over the prospect of so many immigrants leaving the Fatherland:

"O you Rulers of Germany, what would you say if you saw all this? Poor old Europe, what will become of you? . . . You poor North German Lords will have no one left there but officers and beggars. . . . The number of the poor who would like to go is legion. They will remain behind and become the protectors of the country."

After the arrival of the brothers in America, letters of inquiry continue for several years. A letter from Baehr, evidently written after Saxonburg had been selected as the place for the colony, urges the immediate purchase of the land:

"We presume that you will buy the 5,000 acres at $1\frac{3}{4}$ dollars, the amount we have in hand will cover the price of the land after all expenses are deducted. You see you can buy these 5,000 acres immediately. . . . We will have no financial trouble through this respect (subscriptions not yet paid)

THE ROEBLINGS

as there are others who will join us in the purchase of land. Believe we may acquire all the land in the vicinity. Even if the 5,000 acres are \$2.00 each acre, just go ahead and buy as you may be certain by the time summer comes around it will be paid."

As it turned out many of the prospective colonists when they arrived in Saxonburg and looked over the land were dissatisfied with the location and demanded their money back. Their demands appear to have been complied with and they proceeded to establish themselves elsewhere. Upon the whole the brothers seem to have been successful in their land deals and to have made a profit on their venture.

DEPARTURE FOR AMERICA

On May 11, 1831, the brothers left Muhlhausen for Bremen, their port of departure. Neither was ever to see his native land again. When the colonizing party arrived in Bremen they numbered some three hundred souls. It was found that the first ship chartered, the *Henry Barclay*, would not hold them all. A second smaller ship, the *August Eduard*, a bark of 232 tons, was therefore chartered and the brothers took passage on her, being two of the seven cabin passengers with some eighty in the steerage. The vessel left Brake on May 23. This change was perhaps a fortunate thing because the company on the bigger ship, which consisted mainly of Communists, commenced quarrelling at once and split into two sections, the larger half going direct to New Harmony in Indiana and the remainder scattering.

The freedom of personal initiative and the rapid progress in works of a public nature which Roebbling noted in America aroused his astonishment and admiration and finds expression in the following passage:

IMMIGRANT, COLONIST, AND PIONEER FARMER

“The German marvels how all this could take place without an army of councillors, ministers and other officials, discussing the matter for ten years, making long journeys and writing long reports, while the money spent in all these preliminaries comes to more than the actual accomplishment of the enterprise.”

EXCERPTS FROM JOHN A. ROEBLING'S TRAVEL DIARY, 1831

Roebing kept a diary of his eleven-weeks voyage across the Atlantic which was subsequently printed. The title-page reads: “Diary of my Journey from Muhlhausen in Thuringia via Bremen to the United States of North America in the Year 1831. Written for my Friends. Eschwege, 1832, printed in the Roebing Printing House.”

The book contains a minute record of everything which interested him and runs to some 150 printed pages. Only two or three copies are known to exist. The book has recently (1931) been translated into English and privately printed by the Roebing Press at Trenton. A copy of the original German edition was recently presented to Mr. Ferdinand W. Roebing, Jr., by the municipal authorities of Muhlhausen as marking a century since John A. Roebing left his native town to emigrate to America.

The diary includes details of the voyage, including Roebing's observations on nautical matters, a description of all parts of the ship and its equipment, besides personal reflections on the events of each day. Nothing about the ship or the voyage, the crew or the passengers, was too insignificant to escape his notice. His curiosity was boundless and the record includes his thoughts on natural history, meteorology, winds, ocean currents, weather conditions, seasickness and his remedy for it, besides his views on politics, sociology, and economics.

THE ROEBLINGS

Of American ships, their masters, and the conditions on board he has to say:

“Captains without exception are educated men. Americans make speed a point of honor. Use sails when others would not dare to do so. A cow on board gives fresh milk; bread fresh-baked each morning. All sorts of poultry in cages. Many fine wines. Cabin passenger from Liverpool to New York pays 30 guineas; steerage passenger pays 30 dollars, but provides all victuals and his mattress.”

He records a meeting with a supposed corsair:

“A suspicious-looking schooner, fast-sailing, with a long cannon on a revolvable base; strange dark men who cry to one another in a rough, unintelligible tongue; they give the *August Eduard* no greeting with their flag. Captain thinks the ship a pirate which did not dare to attack a ship with so many men aboard and which gave little hope of rich booty.”

He hopes to arrive in time for the celebration of the Fourth of July and makes the following observation:

“This day must be of the greatest interest to every free-minded man, a day on which fourteen million free citizens of a state give thanks for their present condition of freedom and well-being, and on which their brave ancestors, with the splendid and high-minded Washington at the head, cast off the servile fetters of the proud and overbearing motherland.”

This hope was frustrated by contrary winds and it was a month later, August 6, when they reached Philadelphia.

He has this to say about Philadelphia and the consideration shown to foreigners by its citizens:

“Philadelphia is to be distinguished above other cities on account of its politeness towards foreigners. Nowhere does one see a person in rags; all, even the common workmen, go very cleanly and neatly dressed. A German workman, who works

IMMIGRANT, COLONIST, AND PIONEER FARMER

in only shirtsleeves, appears like a chimney-sweep alongside one of these. Poor German immigrants contrast with the humbler classes here in high degree. All are unconstrained and yet very polite in their conduct. I have spoken to no one yet, even when he seemed to be in a hurry, who has not fully replied to my question. Every American, even when he is poor and must serve others, feels his innate rights as a man.

“What a contrast to the oppressed German population!”

THE “AMERICAN LANGUAGE” AND CUSTOMS

“The population here is more generally scattered than in Germany. All speak a pure English. The English of the Americans is distinguished from the pure language in England only in that the Americans lisp the sound ‘th’ and pronounce it more like a ‘sh.’ Also one hears the nasal sounds more here. Here the Negroes are all free and constitute the serving class. Also they go cleanly and decently clad. The removal of the hat and frequent greetings, which are so burdensome in Germany, do not exist here. Even in the parlor the American keeps his hat on, which astonishes a foreigner and seems like lack of politeness. Everyone wears a felt or straw hat with broad brim; the German immigrant is immediately recognized by his cap and his pipe. Only cigars are smoked here.

“Up to now I have not yet found that the Americans seek to cheat more than the inhabitants of the German commercial towns; on the contrary we have always enjoyed fair treatment in making our purchases, and have also not found that they seek to make use of the ignorance of the foreigners.”

He makes the following observation as to the freedom of the press in America:

“How sorry the Americans are for the poor Germans, who are not vouchsafed the privilege of expressing their thoughts freely before the judgment seat of public opinion.”

THE ROEBLINGS

THE DRINKING HABITS OF AMERICANS

“I arrived with the belief that half of the population was never sober; but I have changed my mind. Certainly much brandy is used [he probably means whiskey] in that most Americans are accustomed to mix brandy with water. However, actual drunkards are not more common here than in the great cities of Germany. I believe that such brutish results of drunkenness, beatings, and the like, do not often occur here to the extent of giving public offense upon the streets. The amount of spirituous liquor retailed here is significant. The temperance societies, which have been established in the great cities of the coast, must already have had an influence and greatly lessened the use of brandy.”

He admires the American spirit of cooperation:

“In all arrangements and customs, which concern the common life, the American shows himself to be long-headed; and in this particular he stands higher than the German. The numerous hindering restrictions, and obstacles, which are set up by timid governments and countless bureaucrats against every endeavor in Germany, are not to be found here. The foreigner must be amazed at what the group spirit of these republicans has accomplished up to now and at what it accomplishes daily.”

REMARKS ON PHILADELPHIA BOARDING HOUSES

“In Philadelphia we hired rooms in a ‘boarding house,’ where a person pays three dollars a week for lodging and board inclusive, the latter consisting of ‘breakfast, dinner, and supper’ and is very good. All foreigners proceed in this way, who remain a week or longer. One can also have ‘boarding and lodging’ cheaper and as low as $1\frac{1}{2}$ dollars a week, but naturally poorer in relation to the price. At each meal, morning, noon, and evening, the table is set in the English custom, with coffee,

IMMIGRANT, COLONIST, AND PIONEER FARMER

tea, butter, corn bread, meat, eggs, roast meat, salad, and the like. The landlady pours coffee and does nothing else, but simply gives the invitation, "Help yourself." Nothing further is served. The Americans set to quickly, eat even more quickly, and leave the table without having said a single word. In our house, where there is as much German spoken as English, the arrangement is more according to the German way. Soups are not at all common, their place being taken by coffee and tea."

SLAVERY AND THE DISADVANTAGES OF SETTLING IN THE SOUTHERN STATES

"In general we have been frightened away from the South by the universally obtaining system of slavery, which has too great an influence on all human relationships and militates against civilization and industry with ever-hindering step. Earlier we believed that this circumstance could not hurt us, in that we would permit no slavery. But now we already see, after a few experiences, how hard it would be to accomplish anything with free German workers in a place where all work is done by a despised race of men, namely, the blacks. In time we should see ourselves compelled to hold slaves, and this would have a highly injurious effect upon ourselves and upon the prosperity of the colony. According to news from New Orleans a conspiracy and combination of the blacks has been recently discovered there. They had already secretly collected 10,000 weapons, munitions and the like, and had made the plan to kill the whites in a mass, and thus attain their freedom by force, in the 'sickly' time of the year, namely, in the summer, when there is no trade and life there and a great part of the population has gone away. The example of the Negroes of Santo Domingo, their present independent condition, is too great a provocation for the slaves. Such scenes and horrors will

THE ROEBLINGS

and must occur as long as slavery still exists and as long as the white sons of the gods will not listen to reason. In such situations, however, a German character can never feel at ease. I for my part wish the slaves all good fortune in their efforts to be free. Again, in some Southern States, the most severe orders have been given to give the slaves no education, in order not to make them still more dangerous through more cultivation, than they are already as a result of their condition. Thus the white masters must always live in fear of and in anxiety for their slaves. The Northern States criticize the Southern ones very much, and it is neither lying nor dissembling, and in this all reasonable Americans agree, in saying that slavery is the greatest cancerous affection from which the United States are suffering. Slavery contrasts too strongly with their other political and civic regulations; the republic is branded by it and the entire folk, with its *idealistic* and altogether *purely reasonable* Constitution, stands branded with it before the eyes of the civilized world! Grounds enough for us not to go into any slave-holding State, even if Nature had created a Paradise there! It is hoped that slavery will be entirely abolished little by little; there has been talk about it recently in Maryland.

“On the other hand just as little do we wish to go into the far-distant Western lands, whose boundaries just recently in Missouri and Arkansas have been disturbed by attacks of bands of wild Indians, and where one is cut off from all intercourse and all civilization.”

When John A. Roebling and his brother Karl landed in America they well knew that they had burned the bridges behind them and that now and henceforth they would have to depend entirely on their own resources. It was a big adventure to cross the Atlantic in those days and a still bigger one to essay to make their way in a new country, where everything,

IMMIGRANT, COLONIST, AND PIONEER FARMER

including the language, was unfamiliar to them. John had received a good grounding in English, grammatical and literary, for he had specialized in the study of modern languages at the University; but, as everyone knows, a theoretical knowledge of a foreign tongue is vastly different from possessing a conversational skill. Probably the brothers had improved their opportunities for a better understanding of English during their eleven weeks' voyage by a study of text-books, and, possibly also, they had found some fellow passengers who may have been helpful to them in a colloquial way.

2036132

JOHN A. ROEBLING A HIGH TYPE OF IMMIGRANT

With their education and the capital which had been entrusted to them for investment they were far better off than the majority of immigrants from their own or other countries; indeed, by comparison they were substantial persons and could hope by a judicious purchase of land to enjoy a measure of independence, at least until they should succeed in establishing themselves in some more desirable fashion.

John, at least, was a highly educated man; he had a practical profession and excellent credentials and there would seem to be no reason, after an interval, why he should not be able to secure some suitable position along the lines of his previous technical education and training. In a new country, desperately needing development of its material resources, it should not be difficult to obtain employment in the case of a young man so well qualified as an engineer and architect. But, at least at the outset and to get a start in a new country, he seems to have put all such thoughts out of his mind and to have determined to develop his land proposition and settle down to a farmer's life. The Roeblings were town-bred youths. Neither of the brothers had had previously any experience in agriculture

THE ROEBLINGS

nor had they ever owned any land and the prospect of doing so was doubtless pleasing to them.

Here in this new country there was land in plenty, quantities of it to be had, and almost for a song. The Roebblings had heard all about it long before they left their home and now they were here and with the little capital entrusted to them they could hope to become proprietors of an estate such as was not possible in their native land, except to the very rich. What matter if the work of a farmer was unfamiliar to them? They were young, vigorous and intelligent, and could easily learn it—*labor omnia vincit*.

One commenting on this phase of Roebbling's life, in a discriminating sketch of his career, makes the following observations:

“John Roebbling landed on our shores a young man of twenty-five, seemingly equipped for any battle that awaited him. He was a most accomplished young gentleman. If a wiseacre had predicted his failure it would have been on the very ground that he was too accomplished, that his learning and his talents were too varied ever to focus in a particular vocation—especially the vocation of a farmer, which he had deliberately chosen. He had graduated from the greatest university in the world as an architect and engineer; he was a scholar of wide reading; he was a philosopher of the transcendental sort, whom an American ‘hustler’ would shy at as a dreamer; he was a musician of rare skill and accomplishment; he was a master of three languages, German, French and English—but what had all this to do with farming?”

“And yet he had chosen well, at least, for the time being. . . . His choice had led him to a thorough study of American history and geography. His knowledge of the topography, climatic and political conditions, the advantages and disad-

IMMIGRANT, COLONIST, AND PIONEER FARMER

vantages of the various States in our Union was as accurate as if he had personally visited every one of them."

As previously related, the two brothers landed at the port of Philadelphia on August 6, 1831, and remained for quite a period at a boarding-house in that city; perfecting themselves in English, and considering the relative merits of the various localities which had been brought to their attention as suitable places for making a settlement. Let Colonel Roebing himself tell the story as to their choice and the reasons for it:

COLONEL WASHINGTON A. ROEBLING'S ACCOUNT OF THE SETTLEMENT OF SAXONBURG

"All possible places of settlement were weighed in the balance and mostly found wanting. The South was excluded on account of slavery. The far West was too far, and most recommendations involved too much capital. So, after a few weeks, they departed for Pittsburgh, via the Pennsylvania Canal, crossing the Alleghenies by the portage railroad and inclined planes. During the trip Karl was taken desperately ill with malarial fever and had to be carried some of the way. This circumstance had some bearing on the ultimate selection of Butler County, as being one of the healthiest spots in the State.

"Arriving in Pittsburgh the same dilemma presented itself—where to settle? Ohio almost had the preference, when in some way they were apprised that a Mrs. Collins¹ (whose home, curious to say, was in Trenton, New Jersey—husband, a printer—daughter married Judge McClure of Pittsburgh and was living on South Penn Street in 1858—I boarded next door (1858)) was desirous of selling a large tract of land in Jefferson Township, Butler County, which she had bought at a

¹Widow of Isaac Collins, a Quaker who had established in 1777 the *New Jersey Gazette*, the first newspaper in New Jersey, at Burlington, thence removing to Trenton in 1778, where he continued its publication.

THE ROEBLINGS

very low price and offered at a low figure. She had bought the land from the estate of Robert Morris, the financier of the Revolution. He had bought it from the government, much of it at ten cents an acre, some a little more (Indian lands, soldiers' warrants, etc.). The government was most anxious to have the lands settled."

The lands selected were about twenty-five miles from the then new town of Pittsburgh, and the price paid for the 7,000 acres purchased was at an average rate of \$1.37 per acre. The land was at an elevation of some 1500 feet above the sea and was wholly undeveloped, while the means of communication with the outside world was by rough country roads, almost impassable in the winter. The soil was inferior in the main and would have discouraged any but an optimistic pioneer of small experience.

In less than two years, due to the indefatigable exertions of the Roebling brothers and the little colony of hard-working, thrifty German colonists, whom they had persuaded to associate themselves with them in the venture, this primitive hamlet in the backwoods, at first known as Germania, and afterwards as Saxonburg, presented the aspect of a thriving farming community in which dwelt an industrious and happy people. Let the Colonel resume his narrative and tell how this was brought about:

"Next in order came the laying out of a village, which was done in true German style. One broad main street running exactly east and west, flanked by lots which were from 100 to 200 feet or more in width, and ran back to Water Street, almost half a mile, so that each man had a little farm to himself as is the custom in Germany. Water Street, so called, ran parallel to Main Street, and was considered the poorer quarter. Much of the land was still virgin forest; mostly black oak. What had



Nach der Natur gezeichnet von T. Giesewisch im Juli 1835

Steindruck von E. W. Nebling in. Muhlhausen

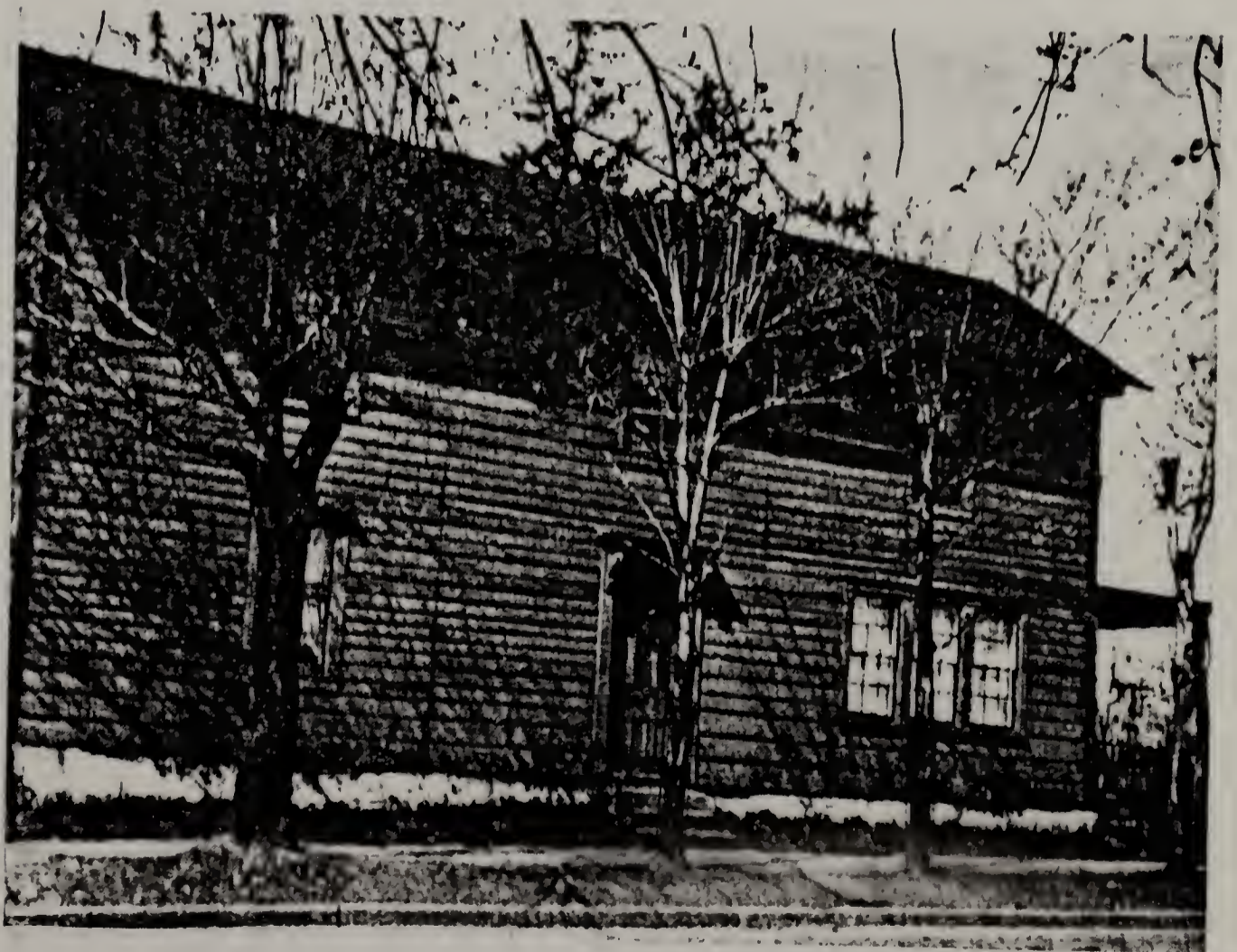
Sachsenburg,
Colonie von Thüringern und Sachsen bei Pittsburg.
 (Von der Südseite.)

- 12 Kettling
- 10 Mader
- 9 Toller
- 8 Bernigay
- 7 Kribgen
- 6 Mül. Dambrecht
- 5 Eckenmann
- 4 Camp
- 3 Kleinbock
- 2 Bär
- 1 Gehr. Nebling

The Village of Saxonburg, Pennsylvania, in 1835, from an Old Print. The Roebling House is on the Extreme Right



The Shop in Saxonburg where the First Wire Rope Was Made, 1841



The Saxonburg Home of John A. Roebling, Built in 1832

IMMIGRANT, COLONIST, AND PIONEER FARMER

been cleared previously had grown up with small, stunted oaks, called black-jack—the home of the so-called pheasant, existing there in great numbers, now almost extinct. Deer and bear were still met with and much smaller game. As late as 1845 a black bear walked down Main Street—he got away.

“The two brothers kept the two largest reservations for themselves. The village is located on a gentle ridge about 1500 feet above sea level. The first house was built at the highest point and occupied by the two brothers until they married. The water from the roof ran in two directions, on one side towards Buffalo Creek and the Allegheny—on the north side toward Thorn Creek, the Cannoquenessing, Beaver and Ohio. From the second story you can see the Chestnut ridge of the Alleghenies.

“The main object of the Roebing immigration had to be tackled now—namely the sale of lots to prospective settlers who had to come from Germany, because these lots were too small for an American farmer. At any rate this location was not very desirable—the winters were very cold. Much of the land was poor, a stiff clay soil, which needed lime, and flat land requiring drainage.

“My father would have made a good advertising agent. He wrote at least a hundred letters to friends in and about Muhlhausen, extolling the virtues of the place—its fine climate—the freedom from restraint—the certainty of employment, etc. Many accepted and came. To each one was sent exact directions how to come, what to take—what to bring along, and what to leave behind. Most tools were to be left behind, because American tools were so much better, such as axes, hatchets, saws, grubbing hoes—nobody could cut down a tree with a German axe. All textile fabrics must be brought. Mechanics of all kinds were preferred, especially those who knew a trade.

THE ROEBLINGS

Two coppersmiths that came acquired a competence in a short time. Terms for payment of land were easy. In a couple of years the village was established and self-supporting. Many worked in Pittsburgh, but maintained their homes in Saxonburg. . . .

“House building was not cheap. A well had to be dug first—usually blasted in solid rock. The earliest houses were real log or block houses—then came the open-work with clay plastering between—only an elegant house could afford clapboards. The sawmill was far off. Most timbers were dressed with broadaxe and fastened with wooden treenails—iron nails were scarce. Some houses had clay floors; when the frame work of a new house had to be raised all the people helped—it was the occasion for a picnic—most of them are standing yet. As years went by cultivation improved—woods were cleared, so that the whole expanse of Thorn Creek Valley is now visible from the Cemetery high ground—but the charm of old woodland is also passing. . . .

“Living was cheap—a side of beef four cents a pound; pork ditto; coffee five cents, sugar same, molasses from New Orleans less yet. Flour, eggs and vegetables from the farmers. The first settlers had planted thrifty orchards, so fruit was cheap, salt came from Tarentum.”

AMALIA ROEBLING WRITES OF THE DEATH OF THE MOTHER AT MUHLHAUSEN, 1832

In the summer of 1832, the mother of the Roebling brothers died and their sister Amalia writes from Muhlhausen under date September 20, 1832, giving them the sad news. She speaks of the ravages of the cholera in the vicinity and of the many deaths which the disease had brought and advises them what remedies to use should the cholera come to America. She is glad to learn that at last they have succeeded in getting female

IMMIGRANT, COLONIST, AND PIONEER FARMER

domestic help in their household. As for herself, she had abandoned the idea which she once cherished of coming to America and states the reason for this decision—a sufficient one as most women will be quick to admit:

“In order to enjoy your muchly-praised freedom we would have to give up our own servants, a thing which we would not like at all, now that we are accustomed to have them. We prefer our comfortable living here to being our own servants there. Ask yourself would you not rather live here in our circumstances than stay there and do your own rough work? This must be much harder on you than on brother Karl. . . . Dear Karl, I am happy that you have found a nice good girl with whom you will be very happy. How are things with you and Antonia, dear August? Have you lost all confidence in me, because you never write about it any more? Keep me posted on what is going on over there. Best regards.”

The reference to Karl is doubtless to his marriage or intended marriage. He did not live long afterwards, dying of sunstroke in 1837 and leaving a widow and two children.

Perhaps Antonia was a young woman to whom John was paying attention. If so it came to nothing for he was married in May 1836 to Johanna, the eldest daughter of Ernst Herting who came to Saxonburg as a colonist from Muhlhausen two years before. The couple lived together for twenty-eight years and had nine children. Mrs. Roebing died in Trenton in 1864.

Further extended references to Saxonburg will appear in a subsequent chapter embodying the personal reminiscences of Washington A. Roebing of his boyhood days in that village.

CHAPTER III

EARLY VENTURES, 1837-1847

*Employment as a State Engineer, 1837—First Wire Rope Made 1841—
Builds Suspension Aqueducts and Monongahela Bridge,
1844-1846—Forecasts Future of the Penn-
sylvania Railroad System, 1847*

IT HAS to be admitted that John A. Roebling, though a good real estate promoter, was not a success as a farmer. He doubtless managed to make a living, though a poor one. But in devoting himself to farming he was wasting his talents, which were adapted to mechanical rather than agricultural pursuits. For the former he was qualified by his scientific education, native endowments and the general processes of his mind, by his tireless energy and his ambition for the definite accomplishment of a utilitarian purpose. His constitutional impatience was irked by the slow uncertain processes of an occupation that depended for success upon the contingencies of soil and weather, and which human effort at best could do little to modify or improve. During a large part of the year, especially in a northern climate, a farmer lacks the active exercise of the energies. He must be content to wait patiently upon events, often frustrated by causes which are beyond his control.

During the years when he was actively engaged in founding a new settlement, building roads, digging wells, designing and erecting houses, there was perhaps a sufficient outlet for Roebling's energies, but with all these things begun and finished there was little or nothing left to do which was adequate to his talents and capabilities. Hence it became evident, unless he

EARLY VENTURES, 1837-1847

should be content permanently to adopt the laborious and undistinguished lot of a small farmer, that it was high time to seek opportunities for a career more suited to his legitimate ambition and talents.

In those days, the 1830's, Pittsburgh, with Saxonburg about twenty-five miles distant, was regarded by Easterners as a sort of *Ultima Thule*,—a mere outpost of civilization on the borders of the then almost unknown and still undeveloped West. To meet the transportation competition with New York which the completion of the Erie Canal in 1825 had brought, and which threatened the commercial prosperity of Philadelphia, the State of Pennsylvania had built a canal with State funds, which had its western terminus at Pittsburgh, thus affording communication by the Ohio River with the rich country beyond. Moreover, about the same time a project for a railroad also through central Pennsylvania, paralleling the line of the canal, was under consideration. The canal was begun in 1826 and was completed in the early 1830's, but it was many years later before the railroad was in operation, at least covering the whole distance. It was to the canal developments of Pennsylvania that Roebling owed the opportunity to exchange his precarious farming for the exercise of the engineering profession for which he had been trained.

TEMPORARY EMPLOYMENT AS STATE ENGINEER

In the spring of 1837 he went to Harrisburg and made his application for employment by the State as an engineer. He was then in the thirty-first year of his age. His application was favorably received, his credentials as an engineer, and his degree of C.E. from the famous Polytechnic Institute of Berlin, doubtless making his way easy. Probably the State authorities deemed themselves fortunate in securing the services of a man

THE ROEBLINGS

so unusually well qualified for the position. The first job assigned him was on the Sandy and Beaver Canal. There he built dams and locks.

This initial employment was evidently a temporary job for we find him writing from Saxonburg under date June 28, 1837, to E. H. Gill, chief engineer of the Sandy and Beaver Canal, in which he expresses the hope of a reengagement under him. He states that he has made applications in other quarters, but that owing to the depressed condition of the times he has so far been unsuccessful. He foresees, however, the coming of better days and therefore hopes soon to find a favorable opening for his services. This letter gives an inkling as to the fertile ideas which were generating in Roebbling's mind at that early period as also his eagerness to begin some constructive work of major importance:

“Although in possession of a fine library and my time being principally occupied by interesting studies, I cannot reconcile myself to be altogether destitute of practical occupation and I shall embrace the first opportunity, which offers itself to me to enter service again. But I should decline any offer, if I could entertain the hope of being reengaged by you, when the times are getting better, to serve under you on the S & B or any other line, you may get in charge. It is always with pleasure that I recollect the time of my service on the S & B and the kind treatment and confidence with which you have favored me.

“During the time of my present leisure I have improved the idea of some new plans and constructions regarding engineering, and I should like to communicate these to you after some time and to submit them to your judgment, before I apply for any patent.

“The first improvement is a new plan altogether for dams

EARLY VENTURES, 1837-1847

and locks to improve the navigation of large Rivers as the Ohio, Monongahela, Allegheny, &—by slackwater. These dams and locks will render the shallowest water navigable during the dry season, without being an obstruction to rafting, without accumulating the sediment in the river channel, and without swelling the water much in time of a flood above the former river. I am confident that these dams can be built in a very solid and permanent manner, with an expense but little increased over what common dams would cost.

“Another plan of mine has reference to the improvement of the channel of the mouth of the Mississippi R. below New Orleans for which purpose large sums of money have been already expended over a number of years without having obtained any permanent beneficial results from the operations executed. The channels of this noble river are filling up every year more and more and the city of N.O. after some time will cease to be the port of entrance for the large kind of sea vessels, unless they adopt a better and more effective plan, suitable to the nature of that river, to keep its channel open and deep. The plan I suggest to that effect, is extremely simple and cheap, and I am perfectly satisfied, would fully answer the purpose, if executed.

“Another improvement of mine regards a simple contrivance in the construction of railroads to make switches and movable rails in turnouts and passings altogether dispensable. This plan will not increase the costs and recommends itself for its simplicity. I have also computed a number of tables, being useful in tracing railroad curves in the field. Any engineer, familiar with the use of these tables, will find them preferable to any other tables, calculated for that purpose and which I know of.”

Roebing's next job was on the feeder of the Pennsylvania

THE ROEBLINGS

Canal on the Allegheny River from Freeport up. After that he was employed in surveying a railroad route over the Allegheny Mountains which later became a part of the Pennsylvania railroad system. It is evident that he must have given entire satisfaction since he was subsequently appointed principal assistant to the chief engineer, Charles L. Schlatter, owing to the illness of the official under whom he had worked as a subordinate. This occupation lasted for two years, and he was able to secure employment in the enterprises, in which he was engaged, for some of his fellow colonists from Saxonburg. Later on his services were used upon the canal at New Lisbon, Ohio.

According to the vouchers which Roebling submitted to his chief, his salary for his engineering services during this period was at the rate of \$4.00 per diem, an amount which the unskilled workman today would repudiate as insufficient.

ROEBLING BECOMES A NATURALIZED CITIZEN, 1837

With a view to a complete identification with the land of his adoption and perhaps also to pave the way for his permanent employment by the State, Roebling took the step, which he doubtless had long contemplated, of becoming a naturalized citizen of the United States. On September 30, 1837, he made his application for citizenship papers before the Court of Common Pleas at Butler, Butler County, Pennsylvania, and, after taking the usual oaths and making the requisite renunciations, was duly registered as a citizen of the United States. He had found his adopted country a good place to live in, and its constitution and laws beneficent, giving him the unhampered personal freedom which his native land had denied him. Above all he found here the opportunities which a new community provides for self-development and individual initiative, condi-

EARLY VENTURES, 1837-1847

tions which were lacking at that period in the Germany of his birth and early manhood.

Privileges of birth and rank, officious interference with the life of the people, and the delays caused by vexatious governmental supervision and red-tape in the accomplishment of pub-

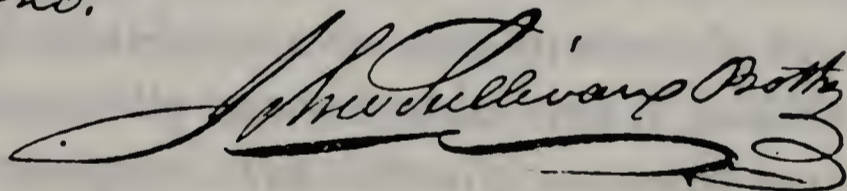
State of Pennsylvania, }
BUTLER COUNTY, } oct.

BE IT KNOWN, That at a Court of Common Pleas, held for the said County, in the town of Butler on the *30th* day of *September* in the year A. D. 1837 before the Honorable the Judges of the same Court; *John A. Roeb-ling*

— a native of *Germany*

came into Court, praying to be admitted a citizen of the United States; and having, to the satisfaction of the Court, made the proofs and complied with the requisitions prescribed by law, was allowed to take the usual oaths, and make the requisite renunciations, which he forthwith did—and thereupon was admitted by the Court a citizen of the United States.

Certified at Butler, under my hand and seal of office, as Prothonotary of the same Court, this *30th* day of *September* in the year A. D. 1837 and of the Independence of the United States the *sixty second*.



The Naturalization Paper of John A. Roebling

lic projects, were among the causes which had led him to emigrate, and he did not regret his decision. Henceforth John A. Roebling was an exemplary citizen, a “one hundred per cent American,” as the flamboyant present-day phrase expresses it. His only objection to things as they were was the system of slavery which prevailed in the South and to which he was always passionately opposed.

THE ROEBLINGS

WIRE ROPE FIRST MADE FOR PORTAGE RAILROADS, 1841

While making surveys over the mountains in connection with his employment by the State, Roebling's familiarity with the workings of the portage railway, with its many inclined planes, stimulated his ingenuity and led to an invention or adaptation of the utmost value to the portage system, and which likewise determined the whole course of his future career.

It should be explained that the method of transportation over the Alleghany Mountains involved the construction of tracks up the mountain side whereby the canal boats with their passengers, after being dismantled, could be placed upon cars and thus hauled to the top by means of huge hempen cables worked by a stationary engine.

A History of Travel in America by Seymour Dunbar, Vol. III, pages 794-796, the Bobbs Merrill Company, Indianapolis, 1915, describes these portage railways and the haulage methods employed on them:

“Between these two settlements [Hollidaysburg and Johnstown] the crest of the Alleghany Mountains attains a height of almost 2300 feet, and it had long been recognized that the lifting of canal-boats over such an obstacle by means of locks was commercially impracticable, even if possible from an engineering standpoint. The difficulty was surmounted by the building of inclined planes, and railroad cars were pulled from Hollidaysburg up the planes to the summit of the range by ropes and stationary engines, and were then lowered down the slope to Johnstown. This method of overcoming mountains was unique in the history of the early railroads of the country. Two stationary engines of thirty-five horsepower each were installed at the top of every inclined plane and the cars were pulled up by endless ropes.

EARLY VENTURES, 1837-1847

“When the westbound traveller reached Hollidaysburg, during the early days following the completion of the entire route, he left his canal boat, took a seat in one of the little cars, designed to carry him over the mountains, and in it was transported some thirty-six and a half miles further along his western way.”

The English story-writer, Charles Dickens, passed over the Pennsylvania route between Philadelphia and Pittsburgh during his first trip to this country, and in the book he afterwards wrote, describing his experiences while here, gave this account of his journey over the Alleghany Mountains:

“On Sunday we arrived at the foot of the mountain which is crossed by a railway. There are ten inclined planes, five ascending and five descending; the carriages are dragged up the former and let slowly down the latter by means of stationary engines; the comparatively level space between being traversed, sometimes by horses and sometimes by engine power as the case demands. Occasionally the rails are laid upon the extreme verge of a giddy precipice, and looking from the carriage window the traveller gazed sheer down without a stone or a scrap of fence between, into the mountain depths below. The journey is very carefully made, however, only two carriages travelling together; and while proper precautions are taken is not to be dreaded for its dangers.”

This same device for crossing heights was also employed on the Morris Canal across New Jersey, between the Hudson River and the Delaware.

The hawsers first used were of Kentucky hemp, $6\frac{1}{2}$ inches in circumference, but they were found inadequate to the work demanded of them, and hawsers of 9 inches in circumference were substituted for them. Some of these hawsers were over a mile in length and cost nearly \$3,000. The total cost of the ropes

THE ROEBLINGS

used on the Philadelphia-Pittsburgh route up to 1840 was nearly \$12,000. As the hawsers became frayed they had to be replaced by new ones and were thus a cause of great expense.

As Roebling contemplated these expensive and clumsy hempen cables the thought came into his mind, why not substitute for them something smaller, stronger and more long-lived? He had read in some foreign scientific journal that a German wire-worker had conceived the idea of twisting a number of wires together in one strand and thus producing a wire rope of great strength and flexibility. The idea took root in Roebling's mind and he forthwith proceeded to experiment as to its practicability. The State Board of Public Works, for whose consideration he presented the notion, were skeptical about it. They had never heard of such a thing as wire rope and no one else had. In fact they did not believe that such a thing was feasible, at least so far as its utility for their purposes was concerned. But the man to whom the thought had come was not discouraged. He had worked the idea out in his own mind and was certain the thing could be done and would prove adequate for the purpose designed. At last they gave in and authorized him to make one such wire rope as he had described and they would test it out. It was in 1841 that the first wire rope was made.

THE FIRST WIRE ROPE FACTORY, 1841

Colonel Roebling, in his *Early History of Saxonburg*, describes the process which his father adopted and the successful issue:

“He had to create the machinery to make the rope. Machinery to make the rope in a factory had not been invented as yet. Recourse was had to using the old rope-walk system. Fortunately for Mr. Roebling his farm possessed a long level meadow,

EARLY VENTURES, 1837-1847

located behind the church, extending to a distance of almost 2,500 feet—an ideal location. A small building (still standing) was put up to splice wire and wind it on large reels for running out. First the separate strands were laid up, seven in number, which were then twisted into the larger rope. The twisting machine was all out in the open and operated by hand-power. No horse-power or steam-power was applicable or available in that early day. The strand-making was continuous, whereas a rope itself was laid up only once in a week or ten days. About ten men were needed for strand-making but sixteen or eighteen were required for laying up the rope.

“Wire rope was adopted on the whole portage; on the Delaware and Hudson Canal Company’s planes, all in Luzerne County, and last, but not least, on the twenty-two planes of the Morris Canal in New Jersey, using very heavy rope.”

When one reflects how wire rope today has become an indispensable commodity of common industrial life, that it is used in a thousand ways its originator could not at that time have foreseen; for hoisting elevators; for rigging and towing ships; for tramways; for transporting lumber, stone, coal and ore over rivers, streams and ravines, and depositing them quickly and cheaply in convenient places for shipment by vessel and railroad—it can be understood what an immense boon this invention, born of the fruitful brain of John A. Roebling some ninety years ago, has been to the world’s commerce and transportation.

There are several letters (1841-1842) dealing with the proposals of John A. Roebling to substitute wire rope for hempen cables on the portage railroads. W. E. Morris of the engineers’ office of the Hollidaysburg portage writes two letters. In the first of these under date January 12, 1841, after expressing an

THE ROEBLINGS

interest in the matter, he proceeds to detail certain mechanical difficulties which he foresees in the way of its successful use:

“It is highly desirable that some means should be devised, by which the heavy annual expenses of ropes upon inclined planes might be reduced. Various plans have been suggested to accomplish this object. You propose to substitute iron in place of hemp, for the material of the cable. The advantages of the plan, if it be found practicable, are many & obvious. The question of its practicability however is one upon which men will doubtless differ much in opinion—and which will not be settled without resort to experiment.”

He doubts whether a small $1\frac{1}{4}$ -inch wire cable could be so adjusted to the hauling apparatus as to serve the purpose as well as the present hempen rope. He thinks a wire cable lacks the flexibility and stretching quality of the hemp and also that the matter of the resistance of wire to inroads of the weather would create a serious problem.

“In case a rope $1\frac{1}{4}$ inches in diameter is passed half round a wheel of 8 ft. diameter, the outside of the chord will be 4 inches longer than the side in contact with the wheel. If the rope used be of hemp, the outer part stretches slightly, while upon the *inner* side the material ‘kinks.’ A wire cable can do neither. I fear the result would be, the frequent fracture of the wires, to the injury & ultimate destruction of the cable. It is absolutely necessary, as you have stated, that the cable be made perfectly impervious to water. The proposed coatings with varnish & paint would completely effect this, was the cable left at rest. But in passing around the sheaves & geared wheels, the strands of wrapping would either be separated on the outer side of the cable, or flattened & crushed together on the inner side. It appears to me impossible that the cable can be strained around the wheels, without one or other of these

results. In either case, the admission of moisture would be the consequence, in time of rain.

“Again, it seems probable, that the same cause (viz., passing round the wheels) will occasion a motion among the strands, attended with friction & the removal of the varnish. On examination of the rope, after the passage of a heavy train, a short, abrupt crook may be noticed, at the point where the ‘stop’ [hitching rope] is attached. The injury to a hemp rope is little, if any. If the same result should attend the use of wire, would not these short bends be permanent? . . .

“The strength of a wire cable $1\frac{1}{4}$ inches in diameter, when new & unimpaired, is amply sufficient for the purposes of transportation, upon the inclined planes of the portage railway. Its want of flexibility, & the difficulty of securely attaching the cars, to so small a cable, appear to me the principal objections to its use. . . .

“It will afford me pleasure to see your drawings of the proposed mode of hitching—and to hear more fully your views upon the proposed improvement when I visit Harrisburg—which will probably be in a short time.”

The second letter dated April 21 of the same year appears to have been written after Morris had made a favorable report as to the use of wire cables. He says:

“My report to the board on the subject of wire cables, has just been made. I think it will coincide nearly with your wishes.” He then proceeds to state that the practical obstacles have been surmounted and that he now anticipates no difficulties in making the proper adjustments.

James Clark writes from Blairsville, February 2, 1842, that he has given consideration to “your plan of putting wire cables on the inclined planes instead of hempen ropes” and states he is “favorable to the project.” He adds: “You must have unlimited

THE ROEBLINGS

confidence in its success to warrant you in making the State such a favorable offer as you propose. And the State or the trade will incur no risque, for even in case of failure the hemp rope can be replaced in a few hours. I hope you may get the opportunity of testing your plan, and raising your fame, by proving the utility and durability of *metallic threads* over vegetable yarns."

L. Chamberlain, secretary of the Beaver Meadow Railroad and Coal Company, writes from Philadelphia August 24, 1842: "Your information respecting wire ropes is highly satisfactory and much more favorable than I expected. . . . If you should be in the city we should be glad to see you and if convenient a specimen of your rope. I have no doubt that it might be extensively introduced into the mining region as being more economical than the chains now used."

ROEBLING'S ASSISTANCE OFFERED TO ELLET

A communication from Roebling under date January 28, 1840, was sent to Charles Ellet, Jr., a well known civil engineer and bridge-builder, and subsequently a rival and sharp competitor of his in the building of wire cable suspension bridges, in which Roebling offers his services as an assistant to Ellet in the work he was then contemplating over the Schuylkill at Philadelphia and over the Mississippi at St. Louis:

"The study of suspension bridges formed for the last few years of my residence in Europe my favorite occupation; as this matter, however, appeared to be little cared for by engineers in this country, I had no occasion whatever to bestow any further attention on it, while engaged in professional pursuits here.

"Some publications of yours, which appeared in the R.R. Journal on the subject of suspension bridges, revived in me the

EARLY VENTURES, 1837-1847

old favorite ideas, and I was very agreeably surprised by the report of your being now actually engaged in making preparations for constructing a wire cable bridge over the Schuylkill at Pha. and another over the Mississippi at St. Louis, which latter indeed would form the greatest construction of the kind in existence. . . .

“Let but a single bridge of the kind be put up in Pha. exhibiting all the beautiful forms of the system to the best advantage, and it needs no prophecy to foretell the effect, which the novel and useful features will produce upon the intelligent minds of the Americans.

“You will certainly occupy a very enviable position, in being the first engineer who, aided by nothing but the resources of his own mind and a close investigation, succeeds in introducing a new mode of construction, which here will find more useful application than in any other country. . . .

“Should you at some future period be desirous of engaging an Assistant for the construction of suspension bridges, who is competent for the task, and who at the same time would execute with pleasure all the necessary drawings, please bear me in mind.”

Ellets reply is written from Philadelphia under date February 8, 1840:

“It has given me much pleasure to learn that you have not neglected the subject of suspension bridges, in pursuing your professional studies abroad; and that you consequently appreciate the merits of that system of construction. It is my intention to endeavor to introduce this improvement in the United States; and shall accordingly pursue those means which appear to me most suitable to convey information to the publick, in the premises, and extend a knowledge of their powers and the principles of their equilibrium.

THE ROEBLINGS

“I have already had one adopted at Philadelphia, and am now engaged in a report for another, and a much more important one, for the Mississippi at St. Louis.

“You correctly estimate the character of the American people, in supposing that they will not fail to recognize the merits of these structures when furnished with one respectable specimen.

“Should the system prevail, as I have reason to believe it will, I hope to have the pleasure of engaging the services of one who is familiar with the subject, and whose aid cannot but be valuable.”

Another letter from Ellet dated March 27, 1841, has to do with the use of wire cables on the portage railroads. Roebling had evidently asked Ellet for an expression of his opinion in regard to the wrapping of the cables:

“I gave the subject of your letter some attention, and came to the conclusion expressed to you on a previous occasion—viz., that the wrapping will necessarily have to be dispensed with. I did not enter into an investigation of all the movements which would take place in a circle of wires, arranged in the mode which you propose; believing it wholly impracticable to cause them to circulate with sufficient ease to answer your purpose. It has occurred to me that the desired effect might be produced either by twisting or plating; but I should feel more confidence in the durability and efficiency of a cable manufactured in the form of a flat band, which might be easily effected, and made so thin that the outer strands would maintain their proper positions by virtue of the elasticity of the material. This is, however, a mere opinion, and I leave it for your ingenuity to make what it can of the suggestion; which I offer with my best wishes for your success.”

EARLY VENTURES, 1837-1847

CORRESPONDENCE WITH ANOTHER BRIDGE ENGINEER

There are three letters from Andrew Young, also a bridge engineer and contractor, who it would appear was at first awarded the contract for the Fairmount Bridge, but which was subsequently transferred to Ellet, as Young claimed, by under-hand methods.

The first letter is dated May 3, 1841, and refers to Roebling's engagement to assist him in the work:

"There has been nothing done with regard to starting the bridge since I wrote you last.

"I think when the County Board meets after they get home, something will be done—therefore I wish you to inform as many of the members as you will have an opportunity of seeing, that you have entered into an engagement with me in assisting to execute the work—and if the work can be started by the first of June we can complete it this season."

The second letter written June 12 of the same year gives the information that the contract had been rescinded and given to Ellet.

The third letter dated June 21 gives an explanation of the transfer of the contract to Ellet, which Roebling had evidently asked for:

"I was well aware that from the time the bridge was awarded to me that Ellet and his partisans were secretly at work undermining and endeavoring to supplant me, but I had no idea that there was sufficient corruption in the board for them to succeed; the event has proved that I was mistaken. . . .

"I wrote you two letters desiring you to come on under the firm conviction that the contract with me was about to be confirmed, but at the very next meeting, their deep-laid schemes were first made visible and at a subsequent meeting they re-

THE ROEBLINGS

scinded the resolutions of the former board and passed a resolution to give the contract to Ellet, 12 to 7. . . .

“I hope we shall have a chance of letting the publick see that he is not the only man that can build those bridges. . . . There is no doubt, if he makes a good job of the Fairmount bridge, there will be a number built afterwards—therefore if you are agreed to enter into partnership with me in building those kind of bridges when any offers—I will go with you hand & hand.”

WIRE ROPE INCREASINGLY IN DEMAND

As time went on, in addition to the use of wire cables for the portage railways there arose a brisk demand for wire rope for the rigging of vessels, for ferries, tow lines and dredges; Roebling's close friend and former chief in the Engineer Corps of the State of Pennsylvania, Charles L. Schlatter, proved most helpful in recommending Roebling's product wherever he saw an opportunity. In 1843 Schlatter left the employ of the State to become United States superintendent of the Harbor of Chicago and in that capacity both with the authorities in Washington and at his own post he was instrumental in securing favorable consideration for Roebling's wire rope. For harbor use at Chicago he himself gives substantial orders for wire rope for dredging machines and pile-drivers and through his acquaintance with ship owners was also helpful in encouraging them to adopt the product.

Schlatter writes to Roebling from Chicago under date November 23, 1843:

“I do assure you that we all (i.e., at the Fort) have the wire rope fever, and we are planning many ways to introduce tillers and rigging upon the Lakes. I only hope the specimens will arrive here this fall, so that they can be shown to the builders of a large brig lately commenced, and on the stocks just oppo-

site the Fort. I feel very certain that if seen, the rigging & tiller would be appreciated even in the specimens.

“I send you a letter to Captain Hunter, I hope it pleases you. I have also desired Captain McClellan to write to him also of you—but I am sure you will need no letter to Hunter, for you both have too many things in common, and your interests will be so similar, that you *must* join forces.”

In a letter of a somewhat earlier date he wrote:

“My influence now at Washington, particularly with the Sec. of War, and Hunter—the inventor of the submerged propellers, is something more than my most sanguine hopes had pictured. If a letter from me to them can serve you, only let me know, and you shall have it.

“My opinion is that you are lost in your present seclusion, and that it would only be necessary for you to be long enough at Washington to become known to the proper persons, and your success will be certain, whilst your reputation and fame will spread as I know it deserves to spread.”

Roebing had written an article on wire rope for the *New York Railway Journal* and under date December 29, 1843, the editor, D. K. Minor, sent him a communication expressing his satisfaction and soliciting his further contributions. In the course of his letter and evidently at Roebing's request, he states that among others he had interviewed Peter Cooper as to the possibility of finding some capitalist who would be likely to be interested in the manufacture of wire rope:

“I communicated your wishes to a gentleman in this city engaged in the manufacture of wire on a limited scale, Peter Cooper, Esqr., a very candid man—& asked him if he could point me to any one who would be likely to engage in the business. He said he did not know of any one—though he

THE ROEBLINGS

thought the time *would* come when it would become an important branch of manufacture.

“I asked Mr. Cooper if he would bear in mind your enquiry & let me know if any opportunity should offer to aid you in carrying out your views, & if he would also like to hear from you on the subject—to which he assured me he would give me any information in his power & would gladly receive any communication you might feel disposed to make.”

The reference to Peter Cooper is significant since it was through his representation that Roebling subsequently selected Trenton as a favorable place for locating his wire rope factory.

Owing to Roebling's success in introducing his product of wire rope, little Saxonburg from a petty farming community soon became a little industrial town. As more and more orders for wire rope were received, farmers were metamorphosed into mechanics and an unlooked-for era of prosperity dawned, alas, too soon to be dissipated by the removal of Mr. Roebling's little plant to another and more accessible locality.

As Colonel Roebling observed:

“To say that the removal of the Roebling interest from Saxonburg to Trenton proved a death-blow to the village is very near the truth. Fortunately the discovery of oil in the neighborhood a few years later tempered its force. By that time Mr. Roebling had sold all his lands.

“On the same meadow where rope was made a gas well was struck, the owners of which converted the gas into lamp-black, at a good profit for many years, until the gas gave out. Just south of Thorn Creek notable wells were struck and enriched their owners.”

John A. Roebling was preeminently an engineer, and it was only by force of circumstances, or a lucky stroke of genius, that he became also a manufacturer, and eventually a rich man.

EARLY VENTURES, 1837-1847

“My father,” said the Colonel, “always held it as a necessity that a civil engineer (one of the poorest professions in regard to pay) should always, when possible, interest himself in a manufacturing proposition—the rope business being established, his ambition prompted him to greater efforts.”

Seven more years, however, were to elapse before Saxonburg was deprived of its little industry and during that period Mr. Roebling found an increasing demand for his services and his wares. In 1842-1843 he was busy making wire rope for the inclined planes, for which he had received orders. Then he struck out upon a new venture.

FIRST WIRE CABLE SUSPENSION AQUEDUCT BUILT, 1844

An account of his work on suspension aqueducts appears in a sketch of the “Life of John A. Roebling,” evidently printed with his approval and included in *Lives and Works of Civil and Military Engineers*, by Charles B. Stuart, C.E., New York, D. Van Nostrand, 1871:

“In 1844 he undertook the building of a wooden aqueduct for the Pennsylvania Canal across the Allegheny River, to take the place of one which had become so unsafe as to render its removal and the erection of a new structure on the old piers necessary. The time for this structure was limited to nine months, including the winter season of 1844-1845. Roebling did this work in the specified time and it was open to commerce in May 1845.

“This aqueduct comprised seven spans of 162 feet each, consisting of a wooden trunk to hold the water, and supported by a continuous wire cable on each side, of 7 inches in diameter.

“A rigorous winter and rapid river current added greatly to the difficulties to be overcome. The novelty of the method of

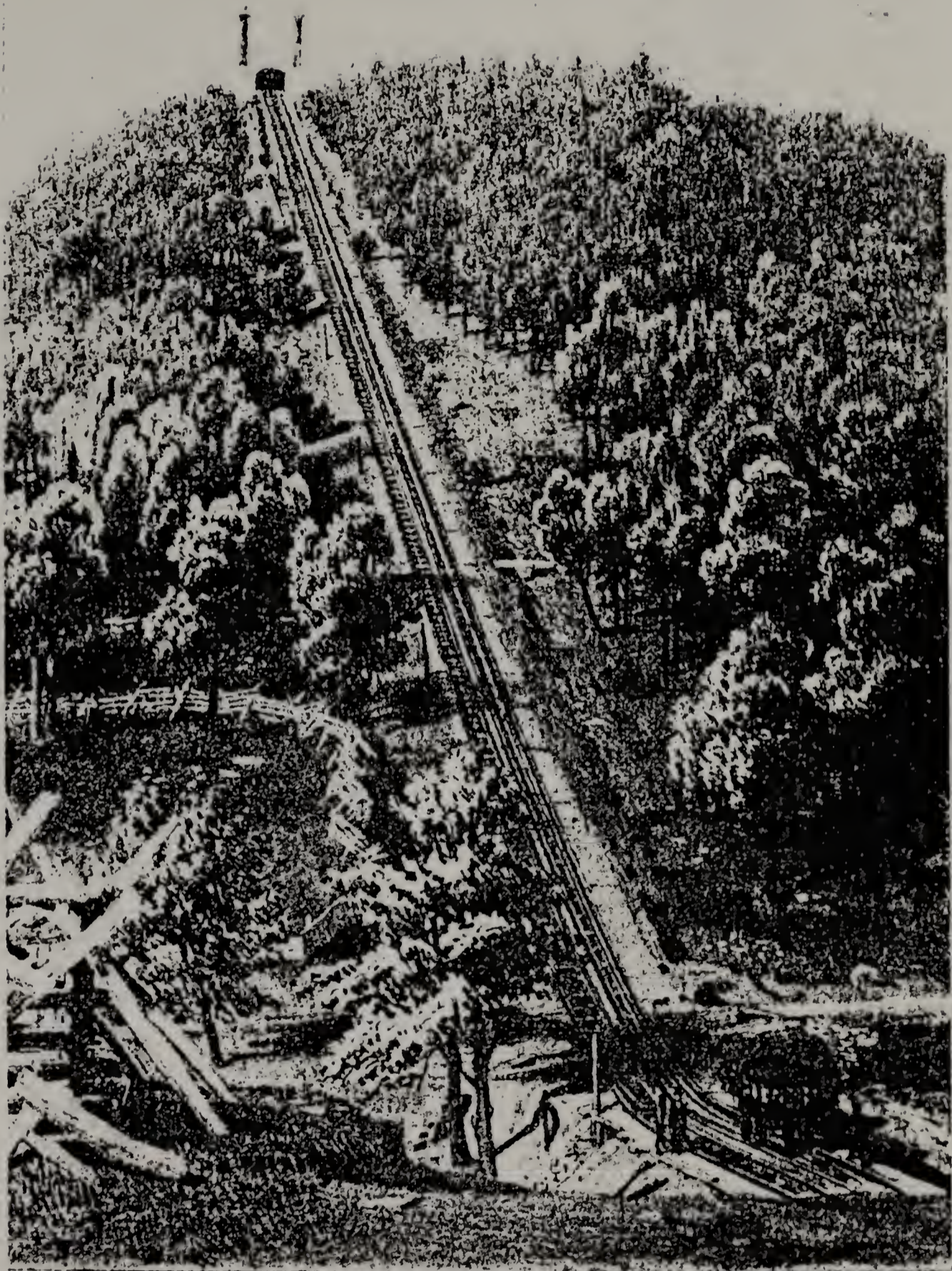
THE ROEBLINGS

construction, the unavoidable imperfections of untried machinery, employed for the first time in making a large cable on the spot it was to occupy permanently, were no light obstacles to be surmounted. One satisfactory phase, however, in the history of the work, and indeed, of a subsequent one also, was the practical refutation its success afforded to the numerous attacks of the engineering profession of that day, which derided, in no small measured terms, the project of a suspension aqueduct; its downfall, as soon as the water should be let into it, was predicted by many who were considered eminent in the profession. This aqueduct was removed in 1861 when the canal was abandoned."

Another and technical description of the work, evidently written by John A. Roebling himself, was printed in 1846 in the *American Railroad Journal* and afterwards reprinted in *The Olden Time*, a collection of papers dealing with the early history of Pittsburgh. It is here stated that including the removal of the old ponderous structure and the repairs of the piers and abutments the construction was completed for \$62,000. The length of the aqueduct without extensions was 1,140 feet, the cables 1,175 feet, the diameter of the cables 7 inches and the total weight of water in the aqueduct was 2100 tons.

The author even at that early date was evidently contemplating the possibility of a suspension bridge capable of bearing the weight of a railway train, for he says:

"This system for the first time successfully carried out on the Pittsburgh aqueduct, may hereafter be applied with the happiest results to railroad bridges, which have to resist the powerful weight and great vibrations which result from the passage of heavy locomotives and trains of cars."



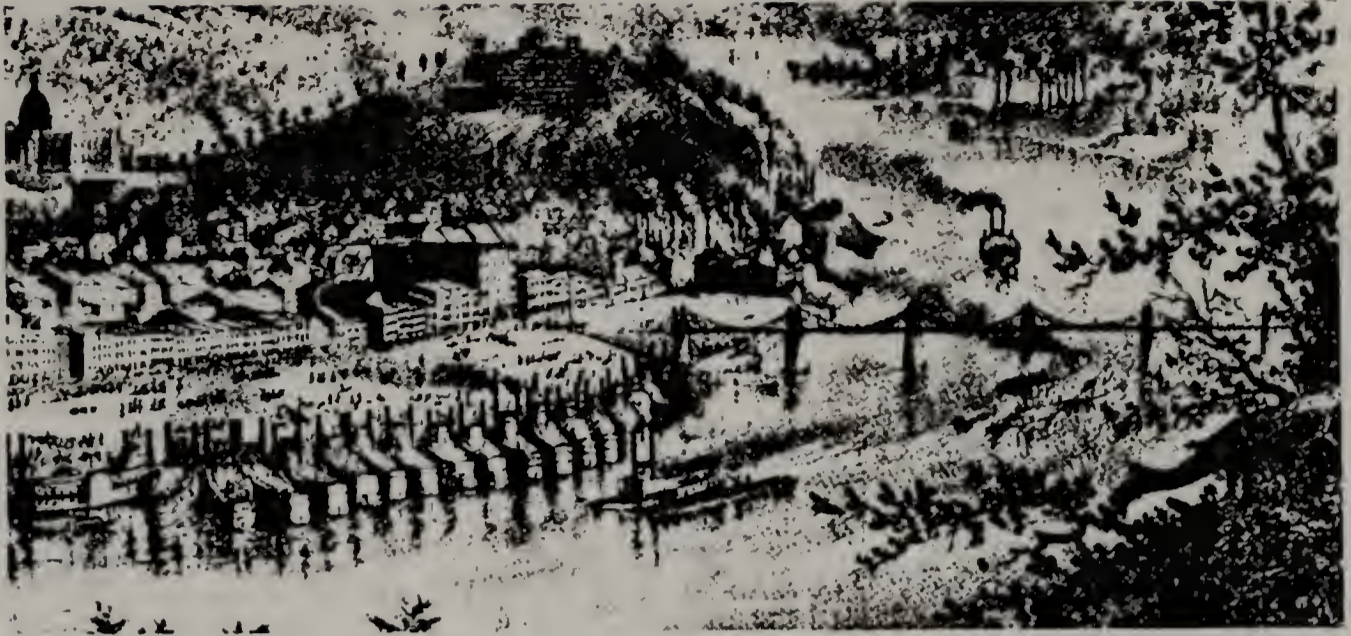
Artist H. P. Osborn. Baltimore.

P. S. Duval & Sons Lith. Phil.

MT. PISGAH PLANE AT MAUCH CHUNK.

Length 2322 feet. Elevation 662 feet.

*The Portage over Mt. Pisgah. It Was for Use on Inclined Planes Such as This
That Wire Rope Was First Developed*



The Bridge across the Monongahela River at Pittsburgh, Built in 1846 by John A. Roebling



The Suspension Aqueduct at High Falls, Pennsylvania, Built by John A. Roebling and Employing the Wire Rope Suspension Principle

EARLY VENTURES, 1837-1847

ROEBLING'S FIRST SUSPENSION BRIDGE, 1846

Following the building of this aqueduct came the erection of Roebling's first bridge, the Monongahela (Smithfield Street) suspension bridge, at Pittsburgh (1845-1846), on the piers of the old wooden bridge destroyed by the great fire of 1844, and which connects that city with the borough of Sligo. This bridge consisted of eight spans 188 feet each, supported by two $4\frac{1}{2}$ -inch cables, which in this instance were constructed on the bank of the river, separately for each span, and afterwards hoisted in place from flat-boats. In this bridge the pendulum principle was applied, to counterbalance adjoining spans under the action of unequal loads.

This bridge continued in service for thirty-five years, carrying the heaviest kind of street traffic, electric cars, steam rollers, and eight-horse teams, drawing heavy trucks, loaded with iron and machinery. The bridge was taken down in 1882 and a contract entered into for building a new suspension on the site, with two river spans of 360 feet and end ones of half that length. But a change of management in the construction company caused the contract to be nullified, and the present two-span lenticular one was erected on the piers intended for the new suspension.

A description of this, his first, suspension bridge, from the pen of John A. Roebling, was published in 1846 in *The New York Railway Journal*, in which he stresses the point of the bridge's stability:

“The peculiar construction of the Monongahela Bridge was planned with a view of obtaining a high degree of stiffness, which is a great desideration in all suspension bridges; this object has been fully attained. The wind has no effect on this structure, and the vibrations produced by two heavy coal

THE ROEBLINGS

teams, weighing seven tons each, and closely following each other, are no greater than is generally observed on wooden arch and truss bridges of the same span. The bridge is principally used for heavy haulage; a large portion of the coal consumed in the City of Pittsburgh passes over it in four- and six-horse teams.

“As a heavy load passes over a span, the adjoining pendulums, when closely observed, can be noticed to move correspondingly—the extent of this motion not exceeding one-half inch. By this accommodation of the pendulums, all jarring of the cast iron towers is effectually avoided. Another object of the pendulums is to direct the *resultant* of any forces to which the work may be subjected, through the center of the towers, as well as of the masonry below.”

The total cost of the bridge was \$55,000 and it was completed in eight months, June 1845 to February 1846.

In 1848 Mr. Roebling undertook the construction of four suspension aqueducts on the line of the Delaware and Hudson Canal, connecting the anthracite coal regions of Pennsylvania with the tidewater of the Hudson River at Rondout. They were all completed within two years, and were of the following dimensions: Lackawanna aqueduct, two spans of 115 feet each, and two 7-inch cables; Delaware aqueduct, four spans of 145 feet, and two 8½-inch cables; Neversink, one span of 170 feet, and two 9½-inch cables.

All these works have now naturally disappeared owing to the changes in the methods of transportation which have come about in the course of the intervening years. But they were universally admired at the time and gave Mr. Roebling as a pioneer in this novel system a high standing among the engineers of his day.

EARLY VENTURES, 1837-1847

ROEBLING FORECASTS FUTURE RAILROAD SYSTEM

During this period of intense activity, Mr. Roebling also found the time to prepare papers on engineering and scientific subjects and in some instances to deliver these before learned societies and public bodies.

In 1847 he read such a paper before the Pittsburgh Board of Trade, which was subsequently published in an extra edition of the *American Railroad Journal*. The subject was "The Great Central Railroad from Philadelphia to St. Louis." Bound up in the same pamphlet was another paper entitled "Location of the Central Railroad through Pennsylvania." The entire pamphlet runs to 12,000 words and must have cost the author many hours to write, to say nothing of the previous study required.

It is to be hoped that the Pittsburgh Board of Trade did not have to listen to the entire contents of these papers, at least during one sitting.

It will be observed that in 1847, when Mr. Roebling was writing, the era of railroads was just beginning and only small portions here and there were in actual existence, though many were then in contemplation. There was then no railroad of any importance west of Pittsburgh, and east of it in the State only a few short lines were in operation, the canals, for the most part of the way, being the only method of transportation.

What Mr. Roebling was pleading for was the building of a central railroad through Pennsylvania and he gives the reasons why in his opinion it was necessary to the future of the State and especially to the city of Philadelphia, if it were to preserve its share of the western traffic in competition with New York, Boston and Baltimore. He considers the engineering problems involved and estimates the cost of the project, which, when finished, he believes would prove a profitable undertaking.

In his introduction he says:

“Railroads and telegraphs may be hailed as the latest offspring of the spirit of the present age; they have inspired a new and most powerful impulse to the social improvement from which will yet flow a vast train of beneficial results. . . . One of the best proofs of the advancement of mankind in true civilization is that the industrial efforts of nations are no longer squandered upon the erection of vast monuments of pride and of war. The partial attempts of improvements during the Middle Ages have been followed by a generous rivalry among nations, states and communities, in the construction of public works of general utility and vast extent, particularly highways, canals and railroads. So far has the system been successfully developed that we may project works with unerring certitude in advance of population and traffic. In place of railroads growing out of commerce and wealth, the former are now creating the latter. Like a magic wand they open the slumbering resources and long hidden treasures of the earth; convert stone and iron into gold; draw into bonds of union and amity isolated individuals, as well as communities and nations; unchain long-cherished prejudices and selfishness and cause to be made more simultaneous executions in all that is useful and good. The noblest feelings and sentiments of man are likewise partaking of the benefits of this general move; they will be roused to greater activity by the enlarged scope rendered accessible by the increased facilities of communication.

“But I may well ask where is the country on earth, as much to be benefited by these modern improvements as our own? We abound in the elements of wealth, but want the means of moving, working and distributing them. Inexhaustible supplies of coal and iron invite us to use and apply them for these and other useful works of art.”

The writer then proceeds to develop his theme in detail and to consider what the other centers in the East, like Boston, New York and Baltimore, are doing to advance their trade with the West. He foresees that unless Philadelphia adopts a forward policy in constructing a system of railways which will tap the fertile valley of the Ohio, and, passing through the States of Ohio, Indiana and Illinois, gain access to the Mississippi at St. Louis, that the city and the State will be left far behind in the progressive movement for capturing the western commerce.

He asserts that canals, though an important and necessary method of transportation, cannot continue permanently to absorb the whole traffic, especially as during the winter months they are not available. He cites the fact that Boston and New York have completed, or are projecting, railroads which will serve to give them access to important western outlets and he calls upon the citizens of Pennsylvania to do likewise.

“The success of the Western Road [referring to the railroad from Boston to Albany] has aroused the energies of New York. A renewed activity on the New York and Erie railroad and the revival of the proposed Albany railroad are the consequences. The roads now in construction or contemplated in New York will be carried on as rival lines and nearly parallel to the Boston system. Lake Erie will in a few years be completely encircled by railroads, connecting with Boston as well as New York. The great example of Boston cannot be represented to the contemplation of the citizens of Philadelphia and Pittsburgh with sufficient force.”

He gives figures to show that Philadelphia is as well and even better situated than New York and Boston, for participation in the Lake trade. “It is quite evident,” he says, that “neither the New York and Erie railroad, when completed, nor the Boston line will be able to compete with the Great Central

THE ROEBLINGS

[Pennsylvania line] provided that the business on the latter can be sufficiently extended to admit of lower fares."

He takes up the threatened competition on the projected route from Baltimore to Pittsburgh and observes that the route of the Central Railroad when finally located would be somewhat shorter and have the advantages of less engineering difficulties. He points out that Philadelphia, as the terminus of the Great Central, would possess superior advantages over Baltimore or Richmond:

"(1) As a greater focus of capital.

"(2) As a greater manufacturing center.

"(3) As a greater commercial point.

"(4) As a more populous place.

"(5) On account of its close proximity to New York, the greatest seaport on the Atlantic."

"The merchants of the West will soon," he says, "have a choice of five great routes, all leading to the Atlantic.

"These may choose to go by the

"Richmond and Ohio,

"Baltimore and Ohio,

"Great Central,

"New York and Erie, or

"Boston and Michigan line.

"We shall not," he concludes, "allow our policy to be governed by feelings of envy; a generous, high-minded, and honorable rivalry shall prompt us to the pursuit of our enterprise—we will remember that the great West offers room for all."

He lays down the following principles, which he believes should guide the Great Central in its operations, principles which are as much applicable today as when Mr. Roebling propounded them:

EARLY VENTURES, 1837-1847

“No two roads shall be made when one can accomplish the business.

“The whole country should be divided into railway systems, with main trunks, forming direct communications between the most important commercial towns, and lateral branches extending through the adjacent country, also connecting with the main trunk lines.

“The main lines shall be so located as to interfere as little as possible with each other.

“The main part of the travel should be accommodated by passing through the principal centers of population.

“The freight business should be attracted from the country itself by branch lines and intersecting improvements which will discharge directly and save transshipment and commission.

“The character of the road as to lines, grades and superstructure should be adapted to the magnitude of the trade; this trade should be estimated with a due respect to the future advance of population, opening of new resources and greater expansion of business generally. In consequence of the increased facilities of transportation offered, the expense of construction may be increased in proportion as the annual charges of transportation, etc., are thereby diminished, with due allowance for the increase of business which may reasonably be expected in consequence of the greater perfection and capacity of the road.”

His conclusion is: “If we proceed in the location of the Great Central according to these principles and secure a connection with the West, before it can be done by our rivals, we shall be certain of success.”


It might be here interjected that a continuous single track was completed between Philadelphia and Pittsburgh in December 1852.

The companion paper under the title, “Location of the Cen-

THE ROEBLINGS

tral Railroad through Pennsylvania," deals with the choice of routes to be selected and the engineering problems to be solved in its construction.

He ends with a prophecy which reveals the author's grasp

 **Read and Circulate.** 

AMERICAN RAILROAD JOURNAL, **Extra.**

THE GREAT CENTRAL RAILROAD,
FROM
PHILADELPHIA TO ST. LOUIS.

BY JOHN A. ROEBLING, C. E.

Read before the Pittsburg "Board of Trade."

The Masthead of the AMERICAN RAILROAD JOURNAL, 1847, containing John A. Roebling's Prophetic Statements about the Pennsylvania Railroad

of the situation, and his remarkable foresight as related to the successful career of the Pennsylvania Railroad, as we contemplate it today over a lapse of nearly eighty-five years:

"In conclusion, I may yet remark that the completion of the Central railroad will, like a great national event, form one of the most remarkable epochs in the history of Pennsylvania.

"For some years past has this important project been allowed to sleep; the prosecution of rival works has caused its revival, and the infant project is now rapidly rising into favor. It needs, however, nourishing, great attention, and sacrifice; but, if properly developed, it promises to return a hundredfold the care bestowed upon it. Its future extension should be west-

EARLY VENTURES, 1837-1847

ward, to those distant regions, which, even now, are ready to pour their rich treasures into our lap.

“Like the New York canal, when it opened those vast and immense resources to the City and State of New York, the Great Central railroad is destined to become the future highway of an immense traffic, not ephemeral in its nature, but most stable and permanent. It will vastly contribute to the wealth of Pennsylvania, and place the future prosperity of Pittsburgh and Philadelphia upon a basis which cannot be shaken.”

There would appear to be available only a single copy of the edition of the *American Railroad Journal* in which Mr. Roebling's papers were published, and that is to be found in the Library of Congress, from which a photostatic copy was secured.

CHAPTER IV

TRENTON, NEW JERSEY, GETS A NEW INDUSTRY

Lays Foundation of Great Wire Industry—Predicts Success of the Transatlantic Cable, 1850—Patents Taken Out by John A. Roebling

IN SAXONBURG the little hand-worked wire rope factory had by this time far outgrown its capacity. The haulage problem had become acute; shipments, especially to the East, where there was a growing demand for Roebling's wire rope for suspension aqueducts and other purposes, were slow and costly. The railroad from Philadelphia to Pittsburgh had not yet been completed, and the Pennsylvania Canal remained for the most part of the way the only method of transportation and involved costly freight and portage charges over the mountains. Moreover, during the winter months the canal was closed, thus causing a cessation of all transportation for four or five months.

In his *Early History of Saxonburg* Colonel Roebling outlines the difficulties of freight transportation to the East, the Delaware and Hudson Canal Company's orders for wire rope being especially indicated:

"A typical journey was as follows: First load the reel on the big wagon; then haul into Freeport (a distance of eleven miles) and load on a canal-boat; then the long trip to Philadelphia; then by the Delaware and Raritan Canal to New York; then up the Hudson to Kingston and Rondout; then transfer to a smaller canal-boat and finally to the point of destination at Carbondale."

It became evident, if Roebling was to maintain and increase



The Old Camden and Amboy Railroad Station, Trenton, circa 1850



The Northwest Corner of Warren and State Streets, Trenton, circa 1850. The Building in the Foreground is the House where Colonel Rall, the Hessian Commander, Was Entertained the Night Before the Battle of Trenton



The Old Trenton City Hall



The Mechanics and Manufacturers Bank of Trenton, circa 1850. Now the First-Mechanics National Bank, an Institution with Which the House of Roebling Has Long Been Connected

TRENTON, NEW JERSEY, GETS A NEW INDUSTRY

his business, it was high time that he should establish himself in a more favorable location before some enterprising individual should forestall him by duplicating his success in a more accessible place, and thus deprive him of the fruits of his original venture.

Probably Roebling had for a long time contemplated a removal, realizing that Saxonburg was about the last place in which to expand his growing business, or even to preserve the start which he had already acquired. His visits to the East had made him familiar with likely spots in which to settle, and among others Trenton had been called favorably to his attention.

REASONS FOR THE SELECTION OF TRENTON

In deciding upon Trenton, as affording a suitable location for his projected wire rope factory, John A. Roebling evidently made no mistake. With his accustomed thoroughness he made a careful investigation of its possibilities as a manufacturing center, and also sought advice on the subject from his friend, Peter Cooper, who in 1845 had established a rolling mill there. This mill was subsequently known as The New Jersey Steel and Iron Company, and early in the present century was taken over by the United States Steel Corporation.

In 1847 Cooper, in company with others, including his nephew, Abram S. Hewitt, afterward mayor of New York City, had organized the Trenton Iron Company, also long afterwards acquired by the United States Steel Corporation as one of its units. Peter Cooper obviously had a shrewd eye open to the possibility of securing profitable relations with the new venture for the sale of his own products. The Trenton Iron Company was for those days a large and important concern, having a capital of \$300,000, employing about one hundred

THE ROEBLINGS

men, and with an annual output, as given in the census reports of 1850, of 2,250 tons of iron, and 350 tons of wire, with a total valuation of nearly \$200,000. Probably Cooper and his associates could not at that time have entertained the idea that the insignificant venture of John A. Roebling in 1849 was destined in a few years to grow to such mammoth proportions, and ultimately to become their greatest rival in the manufacture of wire. Possibly, also, knowing that heretofore Roebling had been accustomed to purchase in the open market the supplies of wire from which to fashion his wire rope, the Trenton Iron Company believed that he would continue to do so, and therefore that their chances as local manufacturers of supplying his needs would be excellent. But whatever hopes they may have cherished at the outset were destined to be unfulfilled, for no sooner was Roebling's little mill established in Trenton than he began immediately to make preparations to draw his own wire and bought only from Cooper and Hewitt the rods from which the wire had to be drawn, and even these were ultimately purchased outside of Trenton from competitors of the Trenton Iron Company or from foreign sources. But these reflections somewhat anticipate the course of events.

When John A. Roebling came to Trenton it was a small town of about 6,000 inhabitants and gave little promise of becoming the large industrial center into which it afterward developed. Yet to a wide-visioned man like Mr. Roebling, the location of Trenton, its proximity to the two great cities of New York and Philadelphia, and its then unequalled transportation facilities by river, canal and railroad, must have suggested the possibility of a large growth in the future, and as being especially adapted at the present for the establishment of another industry in the iron and steel line.

The basic materials of pig-iron, with its by-products, to-

TRENTON, NEW JERSEY, GETS A NEW INDUSTRY

gether with the necessary coal for fuel, were readily accessible, and to be bought at a low cost. The labor market was also excellent, since many skilled iron-workers had been brought to the town by the needs of the various industries already established. Besides Peter Cooper's rolling mill and the Trenton Iron Company, there was the newly organized Phoenix Iron Company which manufactured spikes, boilers, stoves and heavy machinery, and in addition, there were several smaller concerns making sundry iron specialties.

Trenton, indeed, from early colonial days had been a local center for the iron and steel industry. The first steel mill in New Jersey had been established in Trenton by Benjamin Yard in 1745, and Samuel Henry, previous to the war of the Revolution, had extensive iron works in the town. John Fitch, afterwards the inventor of the steamboat, had a shop in Trenton previous to 1776, where he made and repaired muskets for the use of the Continentals and also manufactured military brass buttons and other equipment. During the occupation of Trenton by the British and Hessian forces in December 1776, Fitch's shop was burned by the enemy and he was compelled to seek refuge as a fugitive in Pennsylvania. Thus Trenton had traditions as an iron town long before it came to be recognized as a pottery and rubber center, to which, with the iron and steel mills, it owes its industrial importance today.

LOCATION OF THE ROEBLING PLANT

In August 1848 Mr. Roebling purchased from William Edgar Hunt, an officer in the United States Navy, and a member of a family prominent in Trenton from Revolutionary days, twenty-five acres of land in what was then Hamilton Township, at that time about one mile distant from the center of the city. The ground was undeveloped farmland,

THE ROEBLINGS

with no buildings upon it. The Delaware and Raritan Canal and the Camden and Amboy Railroad skirted one side of the property, thus affording easy shipping facilities. The consideration was \$3,000. The deed is dated November 6, 1848. In this connection it is interesting to recall that the grandson and namesake of John A. Roebling, John A. Roebling, 2nd, the son of Washington A. Roebling, married some forty years afterwards a granddaughter of this same William Edgar Hunt, Miss Margaret Shippen McIlvaine.

A research in the files of the *Trenton State Gazette* yields the following item, under date August 21, 1848:

“Mr. Roebling of Pittsburgh [Saxonburg] has purchased a site for a wire rope factory of Lieut. William E. Hunt, on his farm between the White Horse Road and the Canal, a short distance below the new rolling mill. Mr. Roebling is now very largely engaged in the manufacture of wire rope at Pittsburgh



The Original Trenton Plant of the Roebblings in 1849

[Saxonburg], but desires to remove to this city on account of its superior advantages for his business, so far as the large eastern markets are concerned.

TRENTON, NEW JERSEY, GETS A NEW INDUSTRY

“The wire rope made by Mr. Roebling enjoys a high reputation and his business will no doubt be a large one. The establishment of his factory here will create a new source of wealth in this city and be of special advantage to the new rolling mill which is already adapted to the making of wire.”

CHARLES SWAN BECOMES THE ROEBLING SUPERINTENDENT

Immediate preparations were begun for the erection of a mill, a rope-walk and a dwelling house for the family, who, however, did not come to Trenton until the autumn of 1849. As Mr. Roebling himself was unable to remain in Trenton and oversee these building operations, having to be absent on his various engineering projects, as also to settle his affairs in Saxonburg, he placed in charge of the construction work in Trenton one of his most trusted associates, Charles Swan.

Here is a reference in Colonel Roebling's writings to this Charles Swan:

“Swan was born in Breslau, Silesia, where his father had a calico printing factory. In his day the figures were printed on the cloth with wooden blocks. When engraved cylinder printing was invented he could not accommodate himself to the new ideas, the business fell, bankruptcy and death ensued. The widow with her only son, aged ten, emigrated to America, settling in Pittsburgh. As the boy grew he was apprenticed as a carpenter. When John A. Roebling built the Allegheny aqueduct in 1844-1845 he employed young Swan and was impressed with his ability and skill in many capacities, especially cable making. Hence, when the elder Roebling moved his rope works from Saxonburg to Trenton he engaged Swan to put up the Trenton buildings, establish the long rope-walk and conduct the business. Swan had a good disposition and had the happy faculty of getting along with his employer, an important mat-

THE ROEBLINGS

ter. Owing to the many engineering enterprises of Mr. Roebling, he was away most of the time building aqueducts, suspension bridges, etc. He usually came home in the winter to make plans for Swan."

This Charles Swan played an important part in the Roebling affairs for the next twenty years, and was the superintendent of the mill and the confidential man of John A. Roebling in all his undertakings. Compelled to be away from home for months at a time, the proprietor depended upon Swan to run the business in his absence, giving him full authority to attend to all matters, business and personal, subject only to his own direct orders. While he was absent from Trenton Mr. Roebling wrote to Swan almost daily, giving him the most minute instructions relative to both the manufacturing and commercial ends of the business, and requiring Swan, in turn, to keep him fully informed as to all transactions and happenings. Moreover, while the father was away, Swan seems to have stood *in loco parentis* to the children, and they in turn recognized his authority, and even after they were grown, when they themselves were away, corresponded with him, making him their confidant and submitting to him their various wants.

Swan appears to have been one of those loyal, trustworthy, patient souls, entirely devoted to the interests of his employer, and willing and anxious to subordinate himself in all respects to the wishes of his chief, and this says much, for John A. Roebling was no easy man to get on with, and always demanded an unqualified obedience to orders and visited any infraction with his hot and instant displeasure.

ROEBLING'S LETTERS TO SWAN

John A. Roebling's letters to Swan number several hundred and are devoted almost exclusively to matters relating to the

TRENTON, NEW JERSEY, GETS A NEW INDUSTRY

mill, and tell little or nothing as to his own doings. Rarely are there any allusions to personal and family matters, but business is the absorbing theme—what Swan is to do, and what he is to refrain from doing. He submits sketches for new machinery which he wants to have installed and gives the exact measurements and the places where they can be obtained. He tells of new processes which he wants to have tried out and submits the precise formula for them. He cautions Swan about extending credits to certain customers and instructs him as to lawsuits he wishes to have undertaken. The whole business of the mill, for nearly twenty years, can be reconstructed from these letters.

Roebing carried his ledger and cash-book with him in his travels and enters debits and credits, instructing Swan what bills to pay and what to hold up. He encloses checks to be deposited to his account. His mail is forwarded to him with almost daily letters from Swan, and thus he keeps in close touch with everything of importance at home. He does all this while engaged in the active work of building aqueducts and bridges, besides writing up his diary every night. His energy knows no bounds and his industry never flags. He reads the current technical and scientific journals and makes notes of new inventions and processes which he preserves for future reference. For the periods during which no letters to Swan exist it may be safely assumed that John A. Roebing is at home.

Never in one single instance is the lighter element present in the letters—no humor, no description, no anecdotes—all business, nothing but business. There are few quotable passages in these hundreds of letters, little or nothing that would be of interest to the general reader as disclosing the personal and human side of the writer. Yet, apart from the light which these letters throw upon the operations of the Roebing industry in

THE ROEBLINGS

the early days, they are still valuable as an indirect revelation of character. They show a man so intensely absorbed with his immediate tasks that he has neither the time nor the inclination for anything else. John A. Roebling as an intelligent and observant person must have had many unique experiences during his travels from place to place. He must have met many interesting people, but if so, no inkling of these things crops out in his letters. An individualist, self-contained and self-centered, he seems to have had no interests apart from his work. His energy was stupendous, his concentration perfect, his memory unflinching, his decisions prompt and irrevocable.

He appears always to have been sure of himself and the processes of his brain. What he knew, he knew, and had verified to his own satisfaction, and no one could shake him in the consciousness of his certitude. If he ever relaxed there is no sign of it. If he cherished friendships there is nothing to show it. He never expressed delight over a landscape nor admiration for a work of art.

ROEBLING'S TIRELESS ENERGY

Testimony to his tireless energy is offered in the following excerpt from a speech made by a judicious authority on the occasion of the unveiling of a monument to the memory of John A. Roebling in 1908:

“How and where John Roebling found time to do all he did, to attend scientific conventions and write voluminously for scientific journals, practise the flute and piano, study metaphysics, pour forth his own lucubrations in thousands of pages of manuscript, invent tools and machinery, and make his own drawings for the patent office, design bridges, canals and portage railroads and himself superintend their construction—how he achieved all this, I say, bewilders imagination. And yet,

TRENTON, NEW JERSEY, GETS A NEW INDUSTRY

each night before retiring, his daily journal and note-books must be written up to the minutest detail, if it took till morning. It is related that once during the Civil War, General Frémont sent for him and kept him waiting in the anteroom. Whereupon, Mr. Roebling took a card and scribbled something to this effect: 'Sir, you are keeping me waiting. John Roebling has not the leisure to wait upon any man.' His way was to postpone a conference if the gentlemen with whom he had an appointment happened to be five minutes late in keeping it. It is, of course, this egregious value given to the instant that enabled John Roebling to do the work of ten men; but to my thinking he overdid it."

Yet John A. Roebling could be a faithful friend and benefactor to those who served him well, as is shown in the case of Swan, to whom he left \$20,000 in his will, and urged his sons to take his old superintendent into partnership after his death.

In fairness to his competitors, customers and employees, as these confidential letters abundantly show, he was without fault, though he always exacted his full rights. No man ever doubted his word or his moral integrity and he was always open to appeals to his helpfulness and generosity in the case of the poor and unfortunate. John A. Roebling, though a native of Germany, was master of a lucid English style. He always went directly to the point and never wasted words.

During the winter and spring of 1848-1849 the work of preparation and building went on rapidly under Swan's supervision, as the following local newspaper items show:

Under date December 21, 1848, appears the following:

"The new wire rope factory is going ahead as fast as a large body of men can push it. 'Come on, Gentlemen!—we have room and wages enough for a few more left.' "

The issue for January 21, 1849, reports progress:

THE ROEBLINGS

“The frame for Roebling’s Wire Rope Factory has been put up and the prospect is that the construction of the building and machinery will be prosecuted with energy. . . . Mr. Roebling was the first to construct suspension bridges, and among his works is the suspension aqueduct at Pittsburgh, on the line of the State Canal.”

MORE LETTERS TO SWAN

Mr. Roebling writes Swan from Saxonburg on February 24, 1849, giving instructions about a well which was being dug and with which Swan was having trouble, owing to the pressure of quicksand and caving in. He advises him “to continue until he finds water and a firmer soil and then to widen it to five feet.” He adds that he expects to be back in Trenton by the middle of March, and hopes then to find Swan under roof and plenty of water in the well.

Again, writing from Saxonburg, under date of March 13, 1849, he commends Swan’s action regarding a proposed encroachment upon his land which was projected by the opening of a new road.

“I should certainly object to the loss of sixty-six feet of my front. If they would be satisfied with thirty feet width of road, I might, perhaps, agree to it.”

On April 21, 1849, he writes from Two River, Pike County, Pennsylvania, to express his regret that some trees, which Swan had planted, have not been manured and that they should not grow, and remarks that in the course of another week he will be going to High Falls to commence a new aqueduct. He warns Swan against employing a certain Jonathan Rhule, if he should appear in Trenton, as he was an “Ellet’s man [Charles Ellet, a rival engineer and builder of bridges]. I do not want,” he says, “any news carried between myself and Mr. Ellet—Ellet

TRENTON, NEW JERSEY, GETS A NEW INDUSTRY

has promised Rhule work for no other reason—but because I discharged him.”

He writes from High Falls, June 3, 1849, warning Swan that when laying brick not to forget to have the bricks wetted or saturated with water. “This,” he says, “is a very important matter and indispensable to make a good brick well.”

On July 14, 1849, he writes Swan to push the building of the dwelling house and also the other works, “so that we can commence making ropes on the first of September.” He states that he expects his family to leave Saxonburg for Trenton by the last of August or the first of September, and authorizes Swan, if there should be a public auction about Trenton, to buy some furniture “if good yet, and cheap, for one or two rooms.”

On August 20, 1849, he writes that he finds several orders for wire rope, and “all of them very urgent,” and “to hurry up our works as fast as it can be done.” “We must commence,” he says, “making rope before the first of October. I have promised to ship a rope of 3,000 feet long for Charleston, S.C., on the first of October.” He adds that “Mrs. Roebling and the family will leave Saxonburg on the seventeenth of September, so that they will arrive at Trenton on the twenty-first or twenty-second.”

In his next letter, September 3, 1849, he asks Swan when next he goes to Philadelphia to look at some good stoves for cooking as well as common use. “I must,” he says, “get a cooking stove, and one for the lower room, before my family arrives.”

On September 14 he writes from the Astor House, New York, about securing some good wire-drawers and counsels Swan that if any such appear, to “do as if you know all about wire.” He states that he himself had made arrangements to

THE ROEBLINGS

engage "German wire-drawers, in case any should arrive here, also one or two German machinists, who frequently arrive and get no work. Should any such men come to Trenton we must keep them, put them to the rope business and teach them drawing. Such hands will learn easily and are satisfied with common wages, say, 85 cents per day."

On September 18 he sends a letter introducing a mechanic, one Carl Lange, who he judges will make a good hand at rope making. "Lange has been getting 85 cent wages here, which I will continue to the fifteenth of October, then reduce to 75 cents, for the winter."

He warns Swan not to permit Lange to smoke during work: "He is an inveterate smoker, and I believe he was the cause of a fire, which broke out in my shanty yesterday, but was fortunately discovered in time. The bedding where Lange had been smoking caught fire. I have now strictly prohibited smoking upstairs amongst bedding, where there is danger, and I want you to insist on it and carry out the same rule at Trenton, without exception. Do not let anybody smoke upstairs. I would much rather discharge a good man than lose a building by his carelessness. Tell Fritz, who is also careless and much given to smoking, that he must either quit smoking upstairs or quit work. Do never depart from this rule.

"Last winter we had a most dreadful accident in this neighborhood, when a large shanty burned down and three men lost their lives, the whole caused by smoking amongst bedding."

SOME NEWSPAPER ITEMS

Here are two newspaper items telling about the progress of the work, October 10, 1849:

"Mr. Roebling's new wire rope works commenced operations partially a few days ago. Several wire-blocks are running for

TRENTON, NEW JERSEY, GETS A NEW INDUSTRY

drawing wire. The twisting of wire rope has not yet been commenced. We hear that Mr. Roebling has a large number of orders, and begins operations with prospects of an abundant demand for his manufactures. He uses the very best qualities of iron."

November 13, 1849:

"We mentioned a short time ago the fact that Mr. Roebling's wire rope manufactory had commenced the operations of drawing wire. The machinery for twisting the wire rope has now been so nearly completed that the workmen have commenced that operation also, and have made some wire ropes. The mill will be in full process next week. Mr. Roebling will soon commence the manufacture of a rope about 3,600 feet long, which, when finished, will weigh about six tons. It is ordered by a South Carolina railroad, and is to be used on an inclined plain near Augusta, Georgia.

"Mr. Roebling's railway, on which the machinery is about 4,000 feet long, is now completed. This machinery is so perfect that every strand of wire rope will bear its due proportions of the strain to which the whole shall be subjected. A steam-engine of ten or twelve horse power drives all the machinery. We could not give our readers an intelligent description of the latter if we should try. The quantity of wire rope which the mill will turn out will depend, of course, upon the size. Only the best Norway iron is used in this mill."

Here is the record of an accident which befell Mr. Roebling under date December 29, 1849:

"Mr. Roebling, the proprietor of the new wire rope manufactory, narrowly escaped serious injury at his establishment a few days ago. His hand having been accidentally caught in one of the ascending pulleys, he was suddenly drawn some six or eight feet, when one of the workmen fortunately saw him

THE ROEBLINGS

and stopped the machinery. He fell to the ground, having sustained only some mangling of his hand and bruising of his arm from which he is now recovering.”

ROEBLING APPOINTED CHIEF ENGINEER OF THE NIAGARA FALLS BRIDGE, 1850

An announcement is made, November 16, 1850, of Mr. Roebling's appointment as chief engineer of the Niagara Suspension Bridge:

“John A. Roebling, Esq., of this town has been appointed by the Niagara Falls Suspension Bridge Company to enlarge and improve the suspension bridge in such a manner as to render it fit and proper for the passage of railroad cars. Mr. Roebling will commence the work thus assigned to him in the coming spring, and complete it within the year. The undertaking is in connection with the Rochester, Lockport and Niagara Falls Railroad, the construction of which is to commence without loss of time.”

Here is an item showing Mr. Roebling's interest in a discussion on geology:

“At a meeting of the Trenton Philosophical Society [also known as the Trenton Literary and Philosophical Society] held on Thursday evening, the question was discussed: ‘Is there sufficient reason for believing that the earth was formerly in a fused state?’ Mr. Roebling took part.

“Mr. Roebling alluded to various phenomena of geological formation, which seem to prove the opposite or fusion theory, such as the crystalline structure of the primary rocks everywhere, which led to some further remarks.

“Other remarks were made by Messrs. Brown, Roebling, Sherman, Coleman, Fisher, Livingston, Clements, Cole and Haven in relation to the reconciliation of the history of crea-

TRENTON, NEW JERSEY, GETS A NEW INDUSTRY

tion contained in the Bible with the discoveries of geology in relation to the age of the earth.”

Then as now there was urgent need for charitable relief for the poor. A correspondent writes to the newspaper under date January 24, 1852, acknowledging the receipt of a contribution from Mr. Roebling:

“Mr. Editor:—Permit me to acknowledge through your columns the receipt of ten dollars from John A. Roebling, Esq.,—the first fruits of the appeal made last evening for the poor of Trenton. May many more such gifts be sent in ‘Before the ashes on the hearth-stone of poverty have grown cold, or the tears on the cheek of suffering have had time to dry.’ ”

ROEBLING'S VIEWS ON THE ATLANTIC CABLE, 1850

John A. Roebling had written an extensive letter to the *Journal of Commerce*, which was published April 20, 1850, in which he sets forth with great particularity his conviction that a transatlantic telegraph was a perfectly feasible project. He gives ample reasons for his opinion and furnishes a detailed scheme as to the method to be used in conducting and laying the cable. This would seem to be a remarkable forecast, when it is remembered that it was not until 1854 that Cyrus W. Field became actively interested in the matter, and not until 1858 that the laying of a cable was completed and the first connection with Europe effected. It will be recalled that this first cable only worked for a few weeks and it was not until 1866 that complete and permanent success was attained. Mr. Roebling, writing at a time when few or none had confidence that a transatlantic telegraph was within the range of possibilities, certainly shows a prescience that is little short of marvellous.

THE ROEBLINGS

Here is an announcement of the letter, as it appeared in a local paper April 22, 1850:

“John A. Roebling, Esq., proprietor of the Wire Rope Factory, below the new rolling mill, has furnished the *Journal of Commerce* with a long and ingenious article on a transatlantic telegraph. Mr. Roebling has had much experience in the construction of wire-cable suspension bridges and aqueducts and in the manufacture of wire ropes. He considers the construction of a line of telegraph wire across the Atlantic entirely practicable, and the cost not to exceed \$1,300,000, on which he thinks very large dividends may be expected. Many things which seem preposterous have proved not only practicable, but eminently important and valuable.”

The end of the year 1849 found the Roebling family settled in Trenton in the home built for them by Swan and the little factory in full working order with ample demands for its products.

Judging from the fact that there were only one or two letters written to Swan during the year 1850 it is to be presumed that Mr. Roebling was at home most of the time. Probably during that interval he was working on plans for the Niagara Falls Suspension Bridge, which was the largest and most important structure he had hitherto been called upon to build.

THE RESULT OF THE FIRST YEAR'S BUSINESS, 1850

The Seventh Federal Census, that of 1850, was the first one to take account of the industrial progress of the country and we are indebted to this report for the figures and other information pertaining to the business of Mr. Roebling. The report gives the names and ages of the members of the Roebling family, together with some of the Roebling employees, who are also included, presumably as members of the one house-

TRENTON, NEW JERSEY, GETS A NEW INDUSTRY

hold, comprising in all, with the Roebling family, some eighteen souls, all of whom, with the exception of the Roebling children, appear to have been born in Germany.

The following are the industrial figures:

Products of industry, during the year ending June 1, 1850—

John A. Roebling—Wire Rope

\$20,000 invested in Real and Personal Estate in the
Business

Raw Material Used, Including Fuel:

300 Tons Iron, valued at \$35,000

400 Tons Coal, valued at \$1,200

Kind of Motive Power, Machinery, etc.:

Steam—2 Cupolas

Employees:

20 Males; No Females

Average Monthly Cost of Male Labor: \$500

Annual Product:

250 Tons Wire Rope, Valued at \$40,000

Other Articles Valued at \$1,000

Some idea of the immense increase in the demand for wire rope during the last eighty years may be formed from a comparison between the pitiful 250 tons manufactured in 1850, and the 165,000 tons turned out annually in this country to-day, according to the United States Industrial Reports.

A DESCRIPTION OF SOME PATENTS TAKEN OUT BY JOHN A. ROEBLING BETWEEN THE YEARS 1842 AND 1867

An examination of the patents issued to John A. Roebling during the period 1842 to 1867 show very strikingly the far-reaching vision of his genius. For example, in reading his patent description of an improved steam-engine, he states very

THE ROEBLINGS

definitely that high pressure steam will doubtlessly become practical and economical for power purposes in the early future and the engine that he describes as an improvement and on which he asks a patent be granted is based on the use of high pressure steam. The pressure he suggests is at least 50 per cent higher than the practice at the time he made his application.

His first patent in 1842 has reference to improved methods of manufacture of wire rope and while it might seem quite primitive today, nevertheless it indicates that his dominant thought in the production of wire rope was the maintenance of uniform tension on all the wires in a strand and all the strands in the rope; which, by the way, today is considered to be one of the most vital manufacturing requirements for good wire rope.

He was also quite practical inasmuch as he was always trying to safeguard his operating mechanisms, and the second patent we have record of, issued in 1842, covers an indicating device that shows a condition of low water level in a steam boiler and sounds an alarm by the escape of steam through his indicating device.

The third patent, issued in 1843, is of an entirely different character, but nevertheless of quite some importance: a device for extinguishing sparks; that is, a spark-arrester for locomotives. Doubtlessly the great number of fires started by sparks from locomotives in forests and meadows were of quite some serious consequence in that period and there is no doubt that his particular device would have entirely eliminated this hazard, although we cannot state how practical his particular application would be.

His fourth patent, issued in 1846, covered a special design of anchorage for suspension bridges and with the limited ma-

TRENTON, NEW JERSEY, GETS A NEW INDUSTRY

terials they had to work with in those days, we find it to be a very ingenious combination and we do know that it was used to good advantage on a great number of suspension bridges erected at that time and for quite some period afterwards.

His fifth patent, issued in 1849, had reference to a special closing head for a stranding machine making strand for wire rope. The method he describes in connection with this special closing head is considered good practice even today; in fact, practice during the period from 1880 to about 1900 departed somewhat from what he describes, but since that time there has been a return to the method he describes in his patent description.

His sixth patent, issued in 1854, shows very strikingly his confidence in the ability of wire rope to perform services that evidently was very much in advance of the practice of others at that time. The idea of using a wire rope transmission, that is for the transmission of power by wire rope, over a distance of 3,500 feet, was ambitious to say the least. Nevertheless, he was operating at the Trenton plant a rope-walk that was driven by a wire rope of 7,000 feet in length and proved to be a practical and economical method and doubtlessly had a far-reaching influence in regard to similar applications for wire rope. The fact that wire rope transmissions became a very common source of transmission of power over long distances shortly after his patent was granted, indicates that his pioneer work was the means of introducing this excellent method of power transmission over long distances.

His seventh patent, issued in 1854, is quite removed from his activities at that time, but shows his broad vision inasmuch as this patent covers a special marine type of boiler which develops at least four times the horsepower of existing single boilers at that time. Of course, today boilers of much larger

THE ROEBLINGS

horsepower are manufactured, but they represent no greater advancement over his proposal than his proposal over present practice at that time.

His eighth patent, granted in 1860, covers a combination of steel and wooden girders, which, by the way, has become quite common practice in the last ten years for light-duty members for house construction and light industrial work.

The first patent on railroad passenger cars constructed of iron was issued in 1854 and such a car was built and placed in operation in 1859. Evidently it was difficult to obtain the requisite strength without too great an increase in weight. John A. Roebling's ninth patent, issued in 1860, described a passenger car constructed entirely of iron. By the use of curved thin plates on sides of cars and corrugated thin plates in roof, he was able to get increased stiffness with a great saving of weight compared with flat thick plates as then used. It is rather significant that, today, buildings with metal sides and roofs use corrugated sheets to secure increased stiffness.

His tenth patent, issued in 1865, and his eleventh patent, in 1867, cover an improvement in railroad chairs; that is, a chair for supporting and protecting rail joints, and although we are far advanced today in this development, nevertheless these patents show a full realization of the requirements and the importance of a satisfactory support for rail joints.

For the foregoing comments the author is indebted to Mr. C. C. Sunderland, the chief bridge engineer of the Roebling Company.

CHAPTER V

PROGRESS AND ACHIEVEMENTS

Some Self-Revealing Letters, 1852-1865

THE letters from Mr. Roebling to his superintendent, Charles Swan, continue from 1852 to 1861 in a constant stream, and relate as before, almost exclusively to business matters. From 1861 to 1863 there are few or no letters. This gap was obviously due to the Civil War, when all public works were suspended and John A. Roebling himself was at home. Some contracts for wire rope appear to have been made with the government in connection with the building of military bridges and other purposes. The letters of Colonel Washington Roebling to Swan for that period reveal that some of these bridges were constructed under his own immediate supervision, as an officer in the United States Engineers' Corps. The letters begin again in the spring of 1863, when work on the Cincinnati-Covington Bridge was resumed, and continue for two or three years, after which the correspondence ceases, due doubtless to the fact that Mr. Roebling was then at home most of the time and perhaps engaged in preparing plans for the Brooklyn Bridge, of which he was chosen as the chief engineer in 1867.

From 1852 to 1855 most of the letters are dated from Niagara Falls, where Mr. Roebling was engaged in erecting his famous railroad suspension bridge. He orders various materials for the bridge to be made up by Swan and instructs him as to the conduct of business matters at home generally. He alludes to the Kentucky bridge for which he had a contract and expresses a doubt as to whether progress on it will continue

THE ROEBLINGS

on account of a shortage of funds on the part of the company. After much money had been spent on this bridge, work on it was finally abandoned and never resumed.

He writes under date June 8, 1854, expressing his satisfaction with the result of his work on the Niagara Falls bridge. "My bridge," he says, "is the admiration of everybody, the directors are delighted."

He writes Swan from Niagara Falls expressing surprise over a recent addition to his family. The reference is to the birth of his fourth son, Edmund, January 1, 1854:

"Your letters of the 2nd and 3rd came to hand. You say in your last, that Mrs. Roebling and the child are pretty well. This takes me by surprise, not having been informed at all of the delivery of Mrs. R. Or what do you mean? Please answer by return of mail."

Nothing is too petty to escape his notice. He is dissatisfied with the handwriting of one of his clerks and requests Swan to call the attention of the young man to his delinquencies in this respect:

"He must take pains to improve his handwriting and examine attentively well written letters which you receive and which may serve him as patterns." He submits a sample showing the correct mode of addressing letters:

"The direction should never be put up high in the upper part of the envelope, but rather below the center, else it looks uncommercial-like." Moreover, he objects to being addressed as "Mr. John A. Roebling, Esq., C.E." and directs that letters should read simply "John A. Roebling, Esq."

THE NIAGARA FALLS CHOLERA EPIDEMIC

During July 1854 an epidemic of cholera raged in the vicinity where the Niagara Falls Suspension Bridge was being

PROGRESS AND ACHIEVEMENTS

erected. It was especially virulent in the narrow flats on both banks of the Niagara River and found many victims among the bridge workers. Over sixty persons died during the first week. Patients went into a collapse immediately after being attacked, and many succumbed within six hours. A panic seized the inhabitants, few nurses could be found and the stricken persons were in many cases abandoned and left to their fate. Even those who received treatment did not benefit by it. Homeopathy and hydropathy were both tried, but all remedies alike failed.

Dr. R. J. Rogers, who at that time was the only physician practising in the village, is quoted in a letter printed in the *New York Medical Journal*, November 15, 1884, as making a reference to Mr. Roebling's efforts to minister to the bridge employees:

"The latter form of treatment [hydropathy] was tried most thoroughly by Mr. John A. Roebling, the distinguished engineer. He was a great admirer and personal friend of Preisnitz [a German specialist on the subject], fully believing in his theory. On the morning of that very fatal day he improvised a hospital and had eight patients subjected to that form of treatment, but they *all* died before night."

In a letter written July 29, 1854, Mr. Roebling refers to the epidemic:

"There are no more new cases of sickness. I have saved two by *water treatment*; all the rest are in the grave. The doctors had bad luck. . . . Under the water treatment, as I recommended it to Mrs. Roebling, the patient soon gets hungry and eats. Keep off fear. This is the great secret. Whoever is afraid of cholera will be attacked, and no treatment can save him. . . . Should the cholera appear in Trenton, keep up your

THE ROEBLINGS

courage and do not fear and the disease should not attack you. Best not to think of it at all."

In a sketch of Mr. Roebling's life in *Beecher's Magazine* for January 1871 (a Trenton periodical now extinct) appears the following:

"Mr. Roebling would undoubtedly have been brought down by the disease, as he was constantly exposed to it, had it not been for the exercise of his powerful will. He determined not to have it; but once on one occasion he walked his room all the night long, fighting against symptoms which threatened to make him its victim. The gentleman who related the incident to us said it was the most striking exhibition of the power of mind over disease that he ever witnessed, and probably saved this valuable life. Mr. Roebling offered two stout Germans two hundred dollars to go and set fire to a house where the disease had broken out in a very malignant form. They went and both took the disease, of which they died. . . . During this time the work on the bridge was carried on under the direct supervision of the designer."

THE NIAGARA FALLS BRIDGE A COMPLETE SUCCESS

The Niagara Falls Suspension Bridge was opened for traffic in March 1855 and Mr. Roebling thus describes the event in a letter dated March 20:

"Last Sunday I opened the bridge for the regular passage of trains. The first one was the heaviest freight train that will ever pass, and was made up on purpose to test the bridge. With an engine of 28 tons we pushed over from Canada to New York 20 double cars each loaded with 10 tons, cars weigh'g 7 tons, making a gross weight of 368 tons; this train very nearly covered the whole length of floor between the towers.

"Owing to a heavy ascent on the New York terminus and

PROGRESS AND ACHIEVEMENTS

the great roughness of track just laid down, it took 2 Assistant Engines in front to get up this grade. The bridge settled under this large train 10 inches with a uniform reduction of camber. The rollers under the saddles moved $\frac{1}{2}$ inches forward but everything returned to its place after the Br. was relieved.

“No vibrations whatever. Less noise and movement than in a common trussbridge.

“Yesterday the first passenger train from the East with 3 cars, crowded inside & on top, went over in fine style, altogether we passed about 20 trains within the last 24 hours. Every train after unloading returned to the opposite side, this makes about 20 trips necessary every day.

“No one is afraid to cross. The passage of trains is a great sight, worth seeing it.

“Please communicate the above to Mrs. R., this will save me writing to her.”

A NEW HOME FOR THE ROEBLING FAMILY IN TRENTON, 1855

A new home for the family in Trenton was being contemplated in 1855 from plans made by Mr. Roebling, and he writes to Swan on March 14, directing him to purchase the necessary materials and proceed with the work. The house was built on the factory grounds and remained as the family residence for many years. Subsequent to the death of Mr. Roebling in 1869 it was taken over as the main office of the company and was so used up to a few years ago when it was modernized, a new front erected, and it now houses a clerical department of the business.

Colonel Roebling describes the evolution of the mansion and of the spacious grounds which once surrounded it:

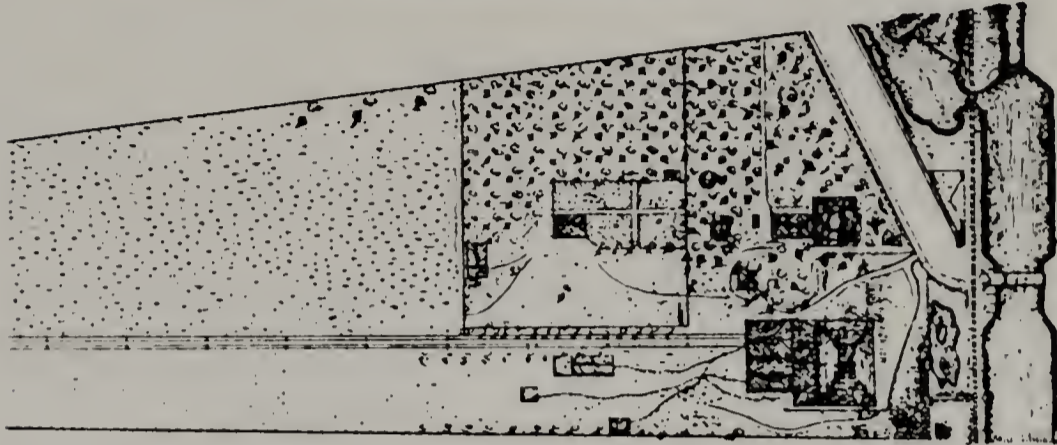
“After John A. Roebling’s death the mansion house was occupied for several years by John H. Stewart and wife (our

THE ROEBLINGS

sister Elvira). After they moved out the place was acquired by the two brothers from the estate and the office transferred from the old bath house to the new building. All land south of a line drawn from the front gate to the back gate was still unused. There was a large garden, a fine orchard, barn, out-houses, icehouse, etc. Ferdinand even raised flowers for sale until the gardener stole the proceeds. It was this small flower business that also interested Charles, and led to his subsequent expansion into an orchid fancier. All these demesnes and appanages have long since disappeared, a voracious ever-growing business has swallowed up all the ground, a small unpretentious machine shop and blacksmith shop had developed into the largest machine shop in town by 1890, additional ground had to be bought on Dye Street, displacing an engine house. At the Clinton Street entrance stands a small building used as a general store which still mounts a weathervane put up by Swan in 1871 or '2. The barn was demolished to make room for a blacksmith shop and general utility building, then came a tempering shop. The large galvanizing shop (now a tinning shop) took most of the orchard. The old garden is replaced by a large tempering shop, 1892, which together with the cutting and straightening shop were joined on to the office about 1900, and later all these buildings were looked upon as ordinary everyday occurrences."

LETTERS OF 1857—THE PANIC YEAR

The letters of 1857 are mostly dated from Pittsburgh where Mr. Roebling was engaged in erecting the Pittsburgh-Allegheny Bridge. This was the great panic year and the letters are full of dire forebodings concerning the financial future of the country. There were wholesale failures of banks and business houses and a widespread depression. He continually cautions



The Roebling Residence and Factory in Trenton, from a Sketch Made by Washington A. Roebling in 1857



Charles Swan, for Many Years an Important Factor in the Roebling Enterprises

My dearly beloved wife, Johanna, after
a protracted illness of 9 months, died
in peace with herself and all the world,
on Tuesday the 22nd November 1864
at 12.30 P. M.

Of those angels in human form,
who are blessing this Earth by their
unselfish love and devotion, this dear
departed wife was one. — She never
thought of herself, she only thought of
others. No trace of ill will towards
any person ever entered her unselfish
bosom. And O! what a treasure
of love she was towards her own
children! No faults were ever
discovered — she only knew
forbearance, patience and
kindness. My only regret is

that such pure unselfishness was not sufficiently
by appreciated by myself. —

In a higher sphere of life I hope to
meet you again my Dear Johanna!

And I also hope that my own love
and devotion will then be more deserving
of yours! —

John Augustus Roebling.

PROGRESS AND ACHIEVEMENTS

Swan to restrict credits and make prompt collections and in all doubtful cases to demand cash before shipment.

There follow in chronological order excerpts from some of the many letters bearing upon this subject:

“The New York banks are good yet, but I fear there is more trouble ahead. We must make safe all we can, while it is time.

“If you have not made a special deposit yet at the Trenton Bk. [Mechanics and Manufacturers] do not wait any longer, that Bk. is *not safe* in times like these. Do not be backward and say to Mr. Fisk [Jonathan Fisk, cashier] that you are bound to carry out my instructions. The Old Pittsburgh Bank has a hard run but keeps up well, paying specie.

“I have answered to Mr. Copeland [his New York agent] that I will rather close my mill than do any more work on credit. But I have offered him credit, provided he gives us good guarantee for payment. I shall make no exceptions with him, and if he does not like it, may do as he pleases. We can sell our rope in N.Y. without him. I am surprised at his letter. *No man is asking credit now*, why should Copeland? I am determined not to make an exception, neither with him nor anybody else.

“Although a general hope is entertained that banks will resume, yet before confidence is restored, there will be more failures, particularly in Pha. & Penna. In the West it is only commencing now.”

.

“I am kept well posted up in regard to the East. I knew about the run in Trenton, and Sterlings' failure. If the directors of the M. & M. Bk. [Mechanics and Manufacturers] are personally responsible, it is only for their circulation, not for the deposits. No Bk. could be made responsible for it by a personal liability clause. Draw out the balance & make special

THE ROEBLINGS

deposit—This can be reduced then gradually by drawing upon it from time to time. So long as their bills are good, we will take them for the hands—but that must be at my option. Mr. Fisk will not like it, but I must serve myself first before I can accommodate him or his speculative directors and other customers, who use their funds.”

.

“All checks we get now, must be drawn out in gold.”

.

“In paying hands we should make use of our Pha. funds and nothing else, so that I do not lose anything in that quarter. Payments on iron can be made by drafts on Penna. & Del. & Huds: I do not want to lose on my deposits in Pha. Bk. For paying hands Pha. money is as good as any other. On the other hand I *prefer* to draw on Penna. & Del. & Hudson—These Cos. may not be able to make sales of coal and will be in trouble and want of cash & who knows? My resources are in the banks and what the Penna. & Del. & Huds owe me, that is all and we must pay our way for a *whole year*. Remember this.”

.

“Business will be very dull next winter & spring, hence the policy of moving on slowly. I think you might commence discharging a part of your men now.”

.

“I am told there is 5 per cent discount on Pha. Checks. All the banks here have suspended except the Old Pittsburgh Bk., which holds out. There is a great excitement among the bankers. It is expected, all the Ohio Bks. will have to suspend.”

.

“I hope you & Washington will carry out my instructions in regard to *special deposits* in New York as well as Trenton. The

PROGRESS AND ACHIEVEMENTS

banks do not accommodate me, but I have always accommodated them.

“For all I can learn, all the Pha. Bks. were in a weak condition, there may be no danger—but at the same time we must not neglect precautions so long as we can.”

.

“Unless the replies of the Penna. Canal Co. are quite satisfactory, we must discharge a portion of our hands at once and reduce them to a *winter force*, only keep our good old hands, also reduce their wages for the winter season. We must prepare for the *worst*. There will be *no* demand for wire rope next year, at least such is my present opinion. The coal business will be very dull and everything else for one year at least. Please state in your next how many ropes you will have to make yet in all, and how much iron you will need and expenses of manufacture.

“The number of failures is increasing every day, where this will end, nobody knows. Only those who are without any debts can weather this storm.”

.

“Almost every rolling mill has stopped. I understand that all the iron men are in a bad fix.”

.

“To make use and good use of Pha. money in Jersey, I now propose to you, that you should go to Pha. one day and purchase with Pha. money a lot of provisions, say \$2 to 300, worth —, say 10 Bbs to 20 Bbls flour, some bacon, ham, coffee, sugar, molasses, rice & &. for our own use, your household and all the hands in our employment. Let all the hands understand, that they will have to take $\frac{1}{2}$ of their wages in provisions & groceries & *coal*, which will be weighed off & sold, once a week, say Saturday, with a *small profit*, enough to cover all expenses & loss by waste. You can convert the *Southpart* of the cellar of

THE ROEBLINGS

the new house into a store room & keep it under lock & key. Have 2 doors put to it, the one next to the wash room, put in next to it, so as to shut off the part under the hall. Things will keep well in that room during the winter. Say to Mrs. Roebling, that she must not buy any more provisions & groceries in Trenton—all must come from Pha. at wholesale prices, bought for bills of the Pha. Bank. This will not only be a saving all around, but also a great service to our hands. We may be able by this means, to employ our old good hands all winter & make rope ahead, and also wire. Mr. Riedel [Edmund Riedel, his nephew] & Washington can manage this store business, & keep a book of entries in the store room, to be squared up every week. Perhaps it will be well to order an additional boatload of egg or stove coal from the Schuylkill region (to be paid with Pha. money) for the use of the hands & our own. You can charge enough to pay well for the labor. If necessary I can send a lot of hams & bacon from here & pay for it with my western funds. We must *not* touch our specie funds in Trenton & N.Y. The Pha. funds will take us through the winter by pursuing the above store keeping plan. This is much better for the hands & ourselves than the plan of the Trenton Iron Co. giving orders & letting hands get skinned.”

.

“In *no* case must our special deposits be touched. Hands must be discharged to the smallest number & paid in provisions & store goods. Provisions will be very low next winter.”

.

“Tonight we get the news that some 8 or 10 N.Y. Bks. have suspended. Things begin to look worse & worse.”

.

“I think, it would be advisable to withdraw the special deposit from the L.M. [Leather Manufacturers] Bk. of N.Y.

PROGRESS AND ACHIEVEMENTS

and put it away in my safe at Trenton & let Washington sleep in that room. The N.Y. Bks. are not out of the woods. Think about this. You might take Ferdy along & a good bag to bring the gold home. Take Mr. Meissner [his nephew] along with you to the Bk. to assist in counting. Should the times continue so severe, then we shall want *all our funds*. In that case I shall *refuse* to make any more rope for Morris Canal, next spring. We will have to look out for Penna & Delaw & Hudson. They will be good, but slow in paying. A good deal will depend upon consumption of coal next winter."

.

"We will have to be very careful not to incur any more liabilities, and look out to have funds enough to pay all we owe & pay the hands.

"Examine the many articles of the Tribune & Ledger every day, also the list of failures."

.

"Those inflammatory German meetings, lately held in Pha. with such exclamations as *Fight or Bread*—indicate what may be expected next winter in these large cities.

"We must economize as much as possible, but keep a *small force* at work, if it can be done at all."

.

"The last accounts from Europe are very gloomy and it is feared the worst is not over. If a panic should break out in Great Britain, it would effectually stop all importation of produce & cotton & times will be worse *here* next spring than they are now."

.

"I wrote you last night & enclosed 1 check of \$2,000 on Pha. Bk. to draw out in gold. By this morning paper I see that

THE ROEBLINGS

all the banks of Pha. have suspended, therefore it is too late. I fear a general suspension all over the country will follow. The Lackawanna R.R. & Coal Co. of N.Y. has also made an assignment, do you not hold their note?

“No more orders filled, except *cash* before shipment—this must be the rule hence forward. You can trust no one.”

.

“Under the present circumstances, we must let all building alone, no carriage house at present—but go on with the hammer & the new machine.”

As will be inferred from the foregoing correspondence John A. Roebling was a prudent and sagacious business man. If his profits were curtailed during the panic period he had at least managed to weather the storm that swept over the country and with the advent of better times he was able to continue his successful career as a manufacturer. Doubtless his engineering fees and investments served to keep him in sufficient funds, even though the wire rope industry was in a state of depression for the time being.

During the winter seasons when outside construction work was at a standstill Mr. Roebling was commonly at home, busy preparing plans for the activities of the following season and making such changes and renovations in his plant as were necessary.

LETTERS OF 1858

The letters to Swan begin again in the spring of 1858 and are mainly written as heretofore from Pittsburgh where he had resumed work on the bridge in company with his son Washington, who had been graduated the year before from the Rensselaer Polytechnic Institute. While he continues to refer to the “hard times” and counsels Swan to be careful in extend-

PROGRESS AND ACHIEVEMENTS

ing credits, he maintains a more hopeful spirit in respect to the financial if not the industrial situation.

He writes about a new process discovered in England of converting good iron wire into steel wire and describes the probable process.

“Respecting the great improvement in the manufacture of wire in England, by which the strength is doubled, I have received some more information on the subject. This wire is made of good iron in the usual way, and converted into steel wire afterwards—it is steel wire, hence its great strength. I have no longer doubt that this improvement will *revolutionize* the whole wire rope business, and if our business is to continue successfully, we will have to fall to work at once to experiment & if possible to manufacture the same kind of wire.

“The process is most probably as follows:

“The wire is finished at an ordinary temper and then carbonized or cemented in close boxes in annealers. Perhaps it may be necessary to clean the wire in limewater. Our annealer if tight may do. Put a layer of good charcoal, pulverized in the bottom, then put in a layer of wire loosely, then a layer of charcoal & so on to the top, the charcoal must completely surround the wire, so that all the wire comes in close contact with carbon. Whether charcoal will answer, I do not know—it does for cementing common steel.”

In a subsequent letter he continues the subject:

“Experience has taught here *in Pittsburgh* that a high conversion can *not* be effected by charcoal dust, but only by charcoal grains of the size of a small pea. Dust will do for low & soft grades of blister, but for a deep hard crystallized conversion the coal must be in grains with sufficient air between, to support a partial combustion.

THE ROEBLINGS

“I wish you to carry out my ideas for the purpose of arriving at facts.

“No opinions, but facts (well ascertained) alone can be of service in such a matter.”

The Lexington and Danville Railroad had been sold at auction and he announces to Swan that he had become one of the purchasers:

“The Lexington & Danville R.R. was sold on the 18th for \$132,150—all told, a work that has cost \$800,000. I am one of the purchasers. We have a good bargain. The members of the association are all good. My cash subscription or liability (besides 5 bonds, which I hold) amount to near \$15,000 in 6 installments, running over a space of 24 months.”

He directs Swan to open his private safe in Mrs. Roebling's presence and send him certain securities which he will find there to be used to complete the payment of his purchase.

LETTERS OF 1859-1860

In the spring of 1859 the Camden and Amboy Railroad, the lines of which skirted the land of Roebling's factory at Trenton, contemplated a change which would involve an encroachment of about one hundred feet upon his property. He writes to Mr. D. G. Stevens, the engineer of the railroad company who had informed him of the project:

“You are certainly not in earnest when you expect on my part a cordial cooperation with the R.R. Co. when such cooperation involves my own destruction. When locating my works I felt sure I should forever be out of the way of any future possible change in the location of the R.R. Should your plan be carried out, it will destroy the whole value of my property, mill, residence & all.—The damage to me would be immense.

“But I shall indulge in the hope that you will be able to

PROGRESS AND ACHIEVEMENTS

modify your plan so as to avoid any encroachment upon my property & with this expectation, I am, Yours sincerely."

He writes to Swan about the matter and encloses Stevens' letter to him, instructing Swan to obtain a legal opinion as to his rights:

"The execution of this plan would be a monstrous injury to my property & must be avoided & *thwarted by all means*. Please take the enclosed letter with my answer to Mr. Beasley [Mercer Beasley, afterward chief justice] & ask his advice—enquire if the R.R. Co. has got the necessary legislation for making such changes & whether the commiss: have been appointed & who they are. Let him make enquiries, if he does not know. . . . What does Stevens (a *young inexperienced* man) want with 100'? He cannot lay down side tracks & pass the canal bridge—that would be obstructing a public thoroughfare—If they want to lay down more than 2 tracks, let them stop at the axe factory and then make a curve in the township road, which is wide enough with 30 ft. . . . Ask Mr. Beasley whether commissioners would have a right to change the location of a township road to my serious injury. Say that Stevens' plan would destroy my whole property. Otherwise keep this matter to yourself & be cautious."

The letters continue through the spring and summer of 1860 and refer mainly to general matters of business, with some references to the Pittsburgh-Allegheny Bridge which was approaching completion. He reports a continuation of dull times in Pittsburgh:

"Times are very dull here, and much worse, as you go West. A very general stagnation of business & no money. No man West of this or South who orders rope, can be trusted unless previously known."

THE ROEBLINGS

He is glad to learn from Swan that many substantial orders for wire rope have recently come in:

“To fill all these orders, will keep you very busy all next summer. It is well you have got through with our improvements & machinery for the present. Always good policy to be prepared for such heavy orders.”

He writes on June 21 regarding the fine appearance of the bridge:

“I have read your letter to Wash. Our bridge stands well & is very firm, less shaking than on a wooden Br. We are now finishing & putting up ornamental work & tollhouses. I cannot leave before end of the month. I do not wish to leave so long as things are in an unfinished condition. When entirely completed this Br. will make a splendid appearance, gilded domes on the towers & well shaped spires on the tollhouses, with cornishes projecting 10' 6" so as to cover the sidewalks, these are some of the features. Washington can leave here on the 1st or 2d July. I will have to return here about the 1st Aug., when all is completed. We are now finishing tollhouses & the ornamental parts of the work, which is a slow business. The bridge will be beautiful, when entirely completed.”

A comparison of the industrial census of 1850 when John A. Roebling began manufacturing wire rope in Trenton with that of 1860 shows a substantial progress, alike in the capital invested in the business, the amount of product and the number of men employed. During the ten years intervening the capital had increased from \$20,000 to \$100,000, the quantity of wire rope from 250 tons to 400 tons and the hands employed from 20 to 30. The fact must also be taken into consideration that for several years previously the business of the country had been prostrated owing to the great financial panic of 1857. Considering the circumstances it must be admitted that the industry had

PROGRESS AND ACHIEVEMENTS

done well in the first ten years of its existence, since it had weathered the greatest financial crisis in the history of the country and was prepared to take advantage of the prosperous times which presumably were to follow in the next decade.

But now there came four years of civil war with its cessation of public works, but also as an offset demands upon industry for vast supplies of all sorts in accordance with which John A. Roebling's little business presumably enjoyed its due share of prosperity.

However much Mr. Roebling may have deplored the necessity for the war between the States, he vehemently hated slavery and as a true patriot was prepared to make such sacrifices for his principles as were required to carry it to a successful completion. For one thing he did not hesitate to encourage his eldest son Washington to offer his services at the very first call for troops, the full particulars of which will be related in connection with Washington Roebling's career as set forth in a subsequent chapter. For himself he proposed a popular subscription and headed it with a sum of ten thousand dollars to arm and equip State troops to defend the flag. It was found later that this voluntary contribution was unnecessary, but the proposal showed his generous spirit and his willingness to make financial sacrifices in the cause of his adopted country.

LETTERS OF 1863-1865

The spring of 1863 found him at Covington, Kentucky, taking up again his work on the Cincinnati-Covington bridge which had been interrupted by the war:

"I have some trouble here with my laborers who struck this morning for a rise. I have paid them so far 1.25 and do not feel inclined to raise their wages. If I do every other builder in the city will be compelled to follow suit. I want to get rid of the

THE ROEBLINGS

Cinc. wharf rats at any rate, and engage Germans in their places. I think after the draft at N.Y. has been enforced at the point of the bayonet, there will be no more trouble. The Germans about here are mostly loyal, the Irish alone are disloyal. We are informed this morning that the last remnant of Morgan's horse-thiefs with Morgan himself have been caught. Things in the South West & West are quite promising, the backbone of the rebellion has been effectually broken. You are doing well by keeping your own counsel with our men about public affairs. No democrat can be trusted, they are all disloyal & treacherous, more or less."

He learned that his son Washington had returned home on leave and is anxious to learn how he fares. He also speaks of Morgan's raid into Indiana:

"Mrs. R. wrote to me, that Washington had been home on a visit. I knew nothing of this, nobody had informed of it. I am anxious to hear from Washington, have you any news from him? I have today got through with the reconstruction & erection of my derricks & would commence laying masonry, if martial law had not been declared on account of Morgan's raid into Indiana, who is about 50 miles from here with 5,000 men. There are about 15,000 men after him to catch him."

It is evident from the following note that he had returned home to spend Christmas:

"CHS SWAN Esq.

Trenton, Dec. 24, 1863.

"Dear Sir

"Mrs. Roebing and myself request the pleasure of your company at dinner at my house on New Year's day the 1st Jany. at 2½ P.M.

"Respectfully & Truly

"Yours

"JOHN A. ROEBLING."

PROGRESS AND ACHIEVEMENTS

The spring of 1864 found him again at Covington, Kentucky. The high premium on gold was giving him at that time great concern and he writes Swan to advance rates on his products proportionately:

“Let all parties understand that we cannot under the circumstances have fixed rates even for *one month*. You will have to inform them, *one and all*, that *no orders can be booked ahead more than one week at fixed rates*. Our prices must rise in the same ratio as gold, iron & wire will rise. All the orders you have now booked ahead, must be subject to increase of prices from *week to week*.

“Our cardprices must be at once raised again to the gold point—and you will have to keep issuing new cards every week, just as other parties do.”

The following day he writes, giving Swan a general formula for replies to customers, who have sent in orders.

“You will have to adhere to the rule, *No prices fixed beyond one week ahead*.

“To avoid trouble & law suits and losses, I wish you also to observe the following rule in your correspondence. On receipt of an order reply as follows:

“Yours has been received. My price for No. . . . is now \$ pr. foot run, subject to change from week to week. Your order will be executed as soon as practicable, but I cannot now fix upon a certain date, so many other orders being ahead; but I will do my best. The invoice will be made out according to the prices ruling at the time. If these terms suit, please advise. I shall not book your order until I hear from you.”

A few weeks later he writes again upon the same subject:

“I want to make a few remarks in relation to money affairs so you may be guided by it in our dealings.

THE ROEBLINGS

“1. It is now well understood that Mr. Fessenden [Secretary of the Treasury] will not issue any more currency.

“2. He will resort to loans here & in Europe. This together with heavy taxation will keep government supplied with all the money wanted.

“3. Mr. Fessenden will have nothing to do with banks. Now Sir these 3 points settled and the future becomes clear. The money market will become tighter and tighter to such an extent, that all those rascally speculators in gold & produce cannot hold their stocks and will be compelled to sacrifice. The country is full of imported goods. Importations will stop. All heavy speculators will go to the wall, and I should not be surprised, that next winter, if our arms should be successful, gold will be down to 150 and every thing else in proportion.

“This is the view entertained by many sensible people. At any rate I have no fears, that gold will go further up, it will go down under the new financial policy of Mr. Fessenden.”

He was much alarmed over unfavorable reports concerning Mrs. Roebbling's health and writes a long confidential letter to Swan requesting him to take certain actions in his behalf. He recommends his favorite hydropathic cure:

“Your remarks about Mrs. Roebbling's condition and her own letter to me are not satisfactory, and leave me to infer, that the worst is not over. Mrs. R. possesses very little recuperative powers of life, and I fear, that the little that is left will gradually wear away, and that her protracted weakness & illness is only the approach to her final dissolution. This thought is gloomy and depressing. I am anxious to see her health restored & her life spared yet for a while, but I am sorry to confess, that my wishes and advice will be powerless & of no avail with her, because she never has paid the least attention to anything

PROGRESS AND ACHIEVEMENTS

I have said or done on this subject of health. Who is her physician? Nobody has informed me.

“Now I request you *as a friend*, to talk *on my behalf* with her physician and ask him, to give you a correct *diagnosis* of her disease, in *writing*, also the history of her illness, and if he chooses, his treatment & candid opinion, all in writing. I have among my friends here 3 distinguished physicians, with whom I shall consult, as soon as I am supplied with a correct description of her disease. . . .

“Give my love to all & read this to Mrs. Roebling.”

It may be stated at this point that Mrs. Roebling died November 22, 1864. Her husband wrote a beautiful and pathetic tribute to her memory and inserted it in the Family Bible; a reproduction of it appears in this chapter.

In August he is again concerned with the high premium on gold and expects to see it go even higher:

“Gold is fluctuating between 250 & 260 and this state of things is likely to last another year. I do not expect that gold will be lower—rather higher. No body can foretell the future. The North will not stand it another year without home rebellion. The only man fit for steering the Union out of its present perils is Butler, but Lincoln wants to be Pres. for another term.”

In September he writes:

“Gold is now dropping down fast and may be down to 100 and even less during the following month. If Gl. Sheridan pushes on to Lynchburg and succeeds in destroying rebel depots and communications thoroughly, then I should not be surprised, if in the month of Nov. Petersburg & Richmond should fall. Mr. Lincoln’s reelection is *certain*, this together with a few more great military successes will reduce the rebel forces to such

THE ROEBLINGS

straits, that a general collapse of the Confederacy becomes a certain, a fixed fact before next spring."

On April 5, 1865, he writes:

"The Army news is glorious, the rebels are now in the last ditch, and the prospects are, that the whole South will be once more in Union traces before the next 4th of July."

A few days later he had learned of the assassination of President Lincoln and thus comments on it:

"The sad bereavement of the Nation by the foul assassination of Pres. Lincoln has produced a strong & deep feeling of bitterness against the Rebels about here. The Rebels have lost their best friend, and the North has to mourn over the fall of a great and *good* man."

He expects hereafter to leave bridge-building to younger folks:

"Miss Elvira informs me, that our grounds look beautiful, and that the new dining room will be the most cheerful & pleasant room in the house. I shall not be able to enjoy it much before this bridge is completed. After that I expect I shall take all the comfort I can get at home & leave bridge building to younger folks.

"I also request you to order, in conjunction with Ferdy & Elvira an appropriate tomb stone for the late Mrs. Roebling, it appears time one should be erected."

CHAPTER VI

THE NIAGARA FALLS AND OTHER NOTABLE SUSPENSION BRIDGES, 1855-1867

IN DESCRIBING the Roebling bridges in this chapter and giving such technical details as was deemed necessary, the author has leaned heavily upon the recognized authorities. He has not felt it necessary to cumber the narrative with notes, but has deemed it sufficient to append to the chapter a bibliography of the main sources of which he has made use.

Suspension bridges are no new invention; the principle has been known for centuries and, indeed, there are examples long previous to the Christian Era.

A brief history of suspension bridges is given in *History of Bridge Engineering* by Henry Grattan Tyrrell, C.E., of which the following represents a short summary:

“The suspension bridge was used in remote ages in China, Japan, India, Tibet, and by the Dyaks of Borneo, the Aztecs of Mexico, and the natives of Peru and other parts of South America. In all early forms the platforms were supported directly on the cables, which consisted of twisted vines or straps of hide drawn tightly to remove floor sag, the cable ends being fastened to trees or other permanent objects on shore.

“Light bridges of this kind, requiring no piers, were economical, and are still common in Peru and in parts of China, India and Ireland. Definite information relating to the early history of bridges in China is lacking, but enough is known to prove that suspensions were used in that country in very remote times. The first one of which the date is given was built A.D. 65 by

THE ROEBLINGS

order of Emperor Ming, in the province of Yunnan, and as described by Kirchen was 330 feet long, with a plank floor resting on chains. Iron chains were used for suspensions in Japan, five hundred years ago or more, at a period when iron was very valuable, and some of these are said to be still in use. Iron suspension bridges were used in Europe as early as 1615 and several are reported in Switzerland in 1650 and in Italy in 1742.

“The first suspension bridge in England (1741) crossed a chasm 60 feet deep and the River Tees near the High Force, two miles from Middleton. Suspension bridges were used in America before any other kind of iron bridge, the first scientific ones of the modern type, with horizontal suspended floor, appearing at the beginning of the nineteenth century. Those previous to 1810 were chiefly the work of James Finley, a native of Fayette County, Pennsylvania, whose first bridge in 1801 over Jacob’s Creek on the turnpike between Uniontown and Greensburg had a span of 70 feet. As the Greensburg bridge was a success, many others were made like it, and the type became the most approved form in the first half of the nineteenth century. The Greensburg bridge had two iron chains, one on each side, with links of the proper length to suit the distance between the suspended floor joist. The chains had a sag of 10 feet, or one-seventh of the span, and passed over masonry towers, with the same angle of inclination on each side, being bolted to four large anchor stones on shore. The suspended wood floor was $12\frac{1}{2}$ feet wide without any stiffening trusses, the whole costing when finished about \$600. Eight similar ones are said to have been erected the same year and about forty more prior to 1808, when patents were granted to Mr. Finley on his designs.”

NOTABLE SUSPENSION BRIDGES, 1855-1867

THE FIRST WIRE SUSPENSION BRIDGE

The first suspension bridge in which wire was the supporting material was built by White and Hazard over the Schuylkill River at Fairmount in 1816. This firm owned and operated a wire mill. The cables used were made of six $\frac{3}{8}$ -inch wires. The bridge had a single span of 408 feet and a passage way of only 18 inches. Notably this was the first wire suspension bridge in any country, all those in Europe being of a later day. This bridge collapsed under a weight of snow and ice the same year it was built. The first wire suspension bridges on the continent of Europe were introduced about 1820, one of these being at Geneva over the Fosse, completed in 1823.

Charles Ellet, regarded as one of the leading bridge engineers in America, in 1842 built a wire suspension bridge over the Schuylkill River at Fairmount, Philadelphia, which remained in use until 1872. It had a span of 358 feet and was supported by wire cables, five at each side, and had a clear width of 25 feet.

ROEBLING, THE FIRST TO BUILD A RAILWAY SUSPENSION BRIDGE

John A. Roebling as will thus be seen was not the first to build wire-cable suspension bridges, though he was an early pioneer in the art and was further to perfect the process and add elements of strength, rigidity and longevity as his special contribution. He was, however, the first to construct a wire-cable suspension bridge capable of bearing the weight of a moving locomotive and train. Long-span bridges of a thousand feet and over were also first successfully constructed by him.

In 1846-1849 Charles Ellet built a wire suspension bridge over the Ohio River at Wheeling, West Virginia, with a cen-

THE ROEBLINGS

tral opening of 1010 feet, which was, when completed, the longest span in the world. This bridge was seriously damaged by a tornado in 1854, when the floor was turned over and all but two cables were broken at the anchorage, and one cable of 150 wires broke at the span center.

John A. Roebling was called in to make the repairs, which he did successfully by uniting the separate strands on each side into solid cables and placing them farther apart at the towers than at the center, thus rendering the bridge more rigid against the wind pressure.

Mr. Tyrrell in his book *History of Bridge Engineering* previously referred to, thus describes the difference in the methods employed by Ellet and Roebling:

“Mr. Ellet used wires in separate strands side by side, with iron bars fastened across them from which the suspenders hung, while Mr. Roebling used wire cables in cylindrical form enclosed and wrapped with light wire to protect them from the weather. In his system the suspenders hung from clamps surrounding the cables, which were generally in planes sloping at an angle from the vertical, with systems of auxiliary stay cables radiating from the towers to successive panel points of the floor system. The stays added stiffness to the floor and relieved the main cables of much load, but the distribution of load on the main and auxiliary cables was uncertain and their use was afterwards abandoned.”

THE NIAGARA FALLS SUSPENSION BRIDGE PROJECTED, 1844

As early as 1844, the project was mooted of building a suspension bridge over the gorge at Niagara. In 1846, Charles Ellet, John A. Roebling, and other eminent engineers were asked to report upon the feasibility and cost of such a bridge, and all reported favorably. Charles Ellet was the successful

NOTABLE SUSPENSION BRIDGES, 1855-1867

competitor and a contract was awarded to him in 1847 to build the proposed bridge. It was to cost \$190,000, to have a span of 800 feet and two 7½-foot roadways, two 4-foot sidewalks and a railway track in the center. As a preliminary operation Mr. Ellet built a foot bridge 7½ feet wide to carry material and supplies for use on the main structure. The main bridge was never finished, at least by Mr. Ellet, who had a controversy with the bridge authorities and withdrew from the work in 1849. The bridge company then chose Mr. Roebling as the engineer, and the bridge, the first railway suspension in the world, was completed by him in 1854.

Charles B. Stuart, C.E., the author of *Lives and Works of Civil and Military Engineers*, wrote to Mr. Roebling in 1846, requesting his opinion as to the feasibility of constructing a railroad suspension bridge over the Niagara River below the Falls. Under date of January 7, 1847, Mr. Roebling wrote his reply which was afterwards published in Mr. Stuart's book in the sketch of Mr. Roebling's life appearing there, and is here given as showing the principles in accordance with which he contemplated the task:

“I have bestowed some time upon this subject since the receipt of your letter, and have matured plans and working details. Although the question of applying the principle of suspension to railroad bridges has been disposed of in the negative by Mr. Robert Stephenson, when discussing the plan of the Britannia Bridge over the Menai, on the Chester and Holyhead Railway, I am bold enough to say that this celebrated engineer has not at all succeeded in the solution of this problem. That a suspension bridge can be built to answer for a railroad, is proven by the Monongahela Bridge, which is only intended for common travel, but with some additional expense could be made stiff enough (it is strong enough) for railroad trains at

THE ROEBLINGS

a moderate rate of speed. Castings of ten tons weight, suspended to two pairs of large timber wheels, have lately been hauled over this bridge; the six-horse coal trains which pass over it hourly weigh several tons.

“It cannot be questioned that wire cables, when well made, offer the safest and most economical means for the support of heavy weights. Any span within fifteen hundred feet, with the usual deflection, can be made perfectly safe for the support of railway trains as well as common travel.

“The greater the weight to be supported, the stronger the cables must be, and as this is a matter of unerring calculation, there need be no difficulty on the score of strength. The only question which presents itself is; Can a suspension bridge be made stiff enough, so as not to yield and bend under the weight of a railroad train when unequally distributed over it; and can the great vibrations which result from the rapid motion of such trains and which prove so destructive to common bridges, be avoided and counteracted?

“I answer this question in the affirmative, and maintain that wire-cable bridges, properly constructed, will be found hereafter the most durable and cheapest railroad bridges for spans over one hundred feet.

“There is not one good suspension bridge in Great Britain, nor will they ever succeed as long as they remain attached to their chains and present mode of superstructure.

“The larger the span, the stiffer it can be made, on account of its great weight, which is necessary to insure stability. To obtain the greatest degree of stiffness, all the timber applied, should, as much as possible, be disposed in the direction of the floors; truss frames, when made, are useful, but need not be applied to a great extent. To counteract the pliability of a cable, stays must be applied, by which a number of points, which

NOTABLE SUSPENSION BRIDGES, 1855-1867

must necessarily correspond with the knots of vibration, are rendered stationary, and so that the stays and cables act in concert in supporting the bridge.

“The locality of the Niagara Bridge offers the very best opportunity for the application of a system of stays, which will insure all the stiffness requisite for the passage of railroad trains at a rapid rate. The plan I have devised for the structure will, I have no doubt, convince you at the first inspection that the rigidity of the structure will be ample. The strength of the cables I have based upon the following calculations:

“Total weight of locomotive and train, two hundred and forty-five tons, the vertical impact of which, when moving at a speed of about twenty miles per hour, will not be less than four hundred tons; to this we have to add the weight of a number of teams which may happen to be on the bridge at the same time a train is passing; also for a foot of snow which may happen to fall during a single night. By adding these items of weight, and allowing *no less than five times* the strength of wire which would barely support the tension resulting from these pressures, for the strength of the cables and stays, we will be found altogether on the safe side; and by securing the cables against all chances of rusting, and preserving all the timber parts of the structure, we will be able to put up a bridge which will last for ages, and offer at all times a safe passage for railroad trains as well as common travel.”

The author of the book referred to adds the following:

“Mr. Roebling manifested his confidence in the success of the enterprise by an offer to construct the bridge on the foregoing principles, with two tracks for common travel, two foot-walks, and one railroad track, within fifteen months, for the sum of \$180,000, subscribe \$20,000 to the capital stock, and

THE ROEBLINGS

give security for the complete success of the work in all its parts.”

As previously observed, this bridge was not built by Mr. Roebling but commenced though not finished by Colonel Ellet. But in 1851 work was begun by Mr. Roebling on a larger and more expensive bridge, which was substituted for it. This was the bridge which first brought Mr. Roebling his great fame, for he proved, against the almost unanimous opinion of engineers in America and Europe, the truth of his contention that a railway suspension was an entirely practical affair. The following account is taken from *History of Bridge Engineering*:

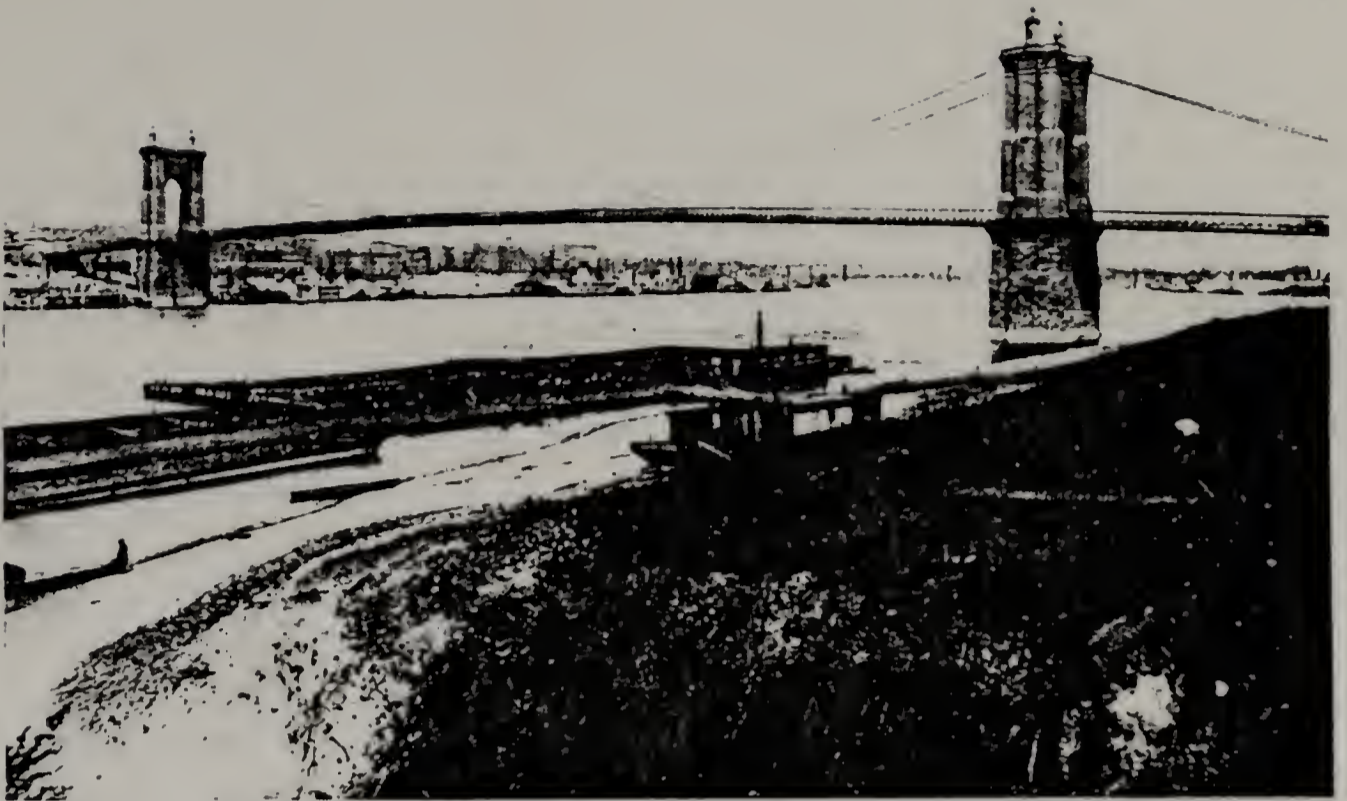
ROEBLING COMPLETES NIAGARA FALLS BRIDGE, 1854

“The Niagara bridge had a span of 825 feet and two decks, the lower one carrying a highway 15 feet wide, partially enclosed at the side by timber stiffening trusses. The upper deck, 24 feet wide and 245 feet above high water, had a single track in the center and was floored over, separating it from the floor below. The floors were suspended at intervals of 5 feet from the upper and lower cables, the deflection of the lower ones being 10 feet more than the upper. There were four cables $10\frac{1}{4}$ inches in diameter, containing 520 wires in each or a total of 3,640, the wires of Mr. Ellet’s old foot bridge being incorporated with the others. The masonry towers were 60 feet high above the road, 15 feet square at the base and 8 feet square at the top, and the bridge was braced laterally against wind pressure by 58 wire guy ropes $1\frac{1}{4}$ inch diameter, fastened to rocks below, the guys detracting considerably from its appearance.”

The bridge was commenced in September 1852, and completed in 1854, at a cost of \$400,000. After forty years of



The Niagara Falls Suspension Bridge, Completed in 1854



The Covington-Cincinnati Bridge, Completed in 1867



The Pittsburgh-Allegheny Bridge, Completed in 1860

NOTABLE SUSPENSION BRIDGES, 1855-1867

service the bridge was replaced in 1897 by the present steel arch, with a span of 550 feet.

The Niagara Bridge has been the only railway suspension bridge in the world that has stood the test of time, the one in Vienna being used for only a short period. The bridge lasted forty-two years and was taken down, not because it was inefficient, but because the heavier railroad trains required a bridge of different construction. When the bridge was taken apart, the wire cables manufactured by Roebling were found to be as elastic as they had been when originally put into their places. The strain of forty-two years had not hurt them.

A "Memoir of The Niagara Falls and International Suspension Bridge," written by John A. Roebling, C.E., in 1855, constitutes the final report of the engineer to the Niagara Falls Suspension Bridge Company. In this report Mr. Roebling sets forth in technical detail the methods of construction used and the quality and strength of the materials. He considers the effects of heavy loads, of temperature, and of high winds as related to the safety and permanency of the work. He notes an interesting point to the effect that the trotting of horses or cattle or the marching of men put a greater strain upon the bridge than the passage of a railway train.

"I will state here that in my opinion a heavy train running at a speed of twenty miles an hour, does less injury to the structure than is caused by twenty heavy cattle under a full trot. Public processions marching to the sound of music, or bodies of soldiers keeping regular step, will produce a still more injurious effect. No bridge constructed without regard to stability will long resist such tests."

In addition to the usual inspection by the bridge authorities the contract required that the completed work should be ex-

THE ROEBLINGS

amined and passed upon by the government engineer of the Province of Canada.

Under date April 30, 1855, Department of Public Works, Quebec, the assistant commissioner of that body, Hamilton H. Killaly, reported to the president and directors of the Niagara Suspension Bridge Companies that "having had repeated opportunities during the course of its construction of judging and observing the careful and scientific attention given to it in all its details . . . I do not require any further proof to satisfy me of its stability and sufficiency for the purpose for which it is designed. . . . The ingenious and talented calculations made of its strength, etc., by Mr. Roebling to which I have had access, convince me fully, that with due care in the maintenance of it, it will be found a safe and permanent work, the principles, plans, and construction of which reflect the highest professional honor on that gentleman."

A method designed by Mr. Roebling to prevent corrosion of the wire cables similar to the process in use by the Roeblings at the present time is thus described:

"Heretofore it had been the practice to lay each wire separately, until the number required for the cable was placed, and to hold them together by bands or coils of wire, placed at short distances apart. Mr. Roebling invented and used for this bridge a machine for winding the cables with small wire from end to end, in a manner that protects them from the action of the atmosphere and binds them, in a degree, into a solid mass."

AN UNFINISHED BRIDGE

Simultaneously with the progress of the Niagara Bridge, another railway suspension bridge was commenced by Mr. Roebling over the Kentucky River on the projected line of the Lexington and Southern Kentucky Railroad. The gorge to be

NOTABLE SUSPENSION BRIDGES, 1855-1867

crossed here was both wider and deeper than that at Niagara, requiring a span of 1224 feet. The anchorages were laid and the stone towers erected, and most of the cable wire and other material for the superstructure delivered at the site, when, the company becoming financially embarrassed, the work was suspended and has not since been resumed. In this bridge no carriageway was designed, and the plan of the structure was essentially different from that of the Niagara Bridge.

THE CINCINNATI-COVINGTON BRIDGE

In 1846 Mr. Roebling devised plans for a suspension bridge over the Ohio River between Cincinnati and Covington, but the completion of the bridge was delayed, first by the lack of funds and subsequently by the outbreak of the Civil War. The work was resumed but with different plans in 1863 and finally completed in 1867.

In his final report made to the bridge company in 1867, Mr. Roebling noted:

“At the lowest stage of water the Ohio River, between Cincinnati and Covington, has a width of about 1000 feet. By the charter of the Company the position of the towers was fixed at low-water mark, so that the middle span should present an opening of not less than 1000 feet in the clear. In the spring of the year 1832 the river rose sixty-two feet above low water. At this stage the width of waterway is over 2000 feet. With the exception of the towers, the whole waterway between the two cities is left unobstructed, a width of 1619 feet. The two small spans left open between the abutments and towers are each 281 feet, from face to center of towers. From an engineering point of view, this division of spans is not the most economical. The cheapest arrangement would have been one center span of 800 feet, and two half spans of 400 feet each.

THE ROEBLINGS

But that plan had been forestalled by previous legislation. One of the early charters decreed one single span of 1400 feet in the clear. But this very great and expensive span was afterwards allowed to be reduced to 1000 feet, and with this amendment the foundations were commenced in 1856.

“Owing to the persistent opposition of property owners, steamboat and ferry interests, the clear elevation of the floor above low-water mark, in the center of the river span had been fixed at 122 feet. By a later enactment, this height was reduced to 100 feet. As the bridge stands now, its elevation is 103 feet in the clear above low-water mark, at a medium temperature of sixty degrees, rising one foot by extreme cold and sinking one foot below this mark in extreme heat. The greatest ascent is only five feet in one hundred, at the Cincinnati approach, and this diminishes as the suspended floor is reached.”

He follows with a technical description of the bridge, stressing the strength and stability of the construction and points out that with a small addition to the cost the bridge could have been made capable of bearing the weight of railway trains:

“The floor of the bridge is formed of a strong wrought-iron frame, overlaid with several thicknesses of plank, and suspended to the two wire cables by means of suspenders attached every five feet, arranged between roadway and footpaths; the latter seven feet wide, and are protected by iron railings towards the river. The roadway is twenty feet wide, forming two tracks of four lines of iron trams, on which the wheels run, each tram being fourteen inches wide, to accommodate all kinds of gauges. The whole width of the floor between the outside railings is thirty-six feet. No stays or other obstructions are put up below the floor, such as may be seen under the Niagara bridge. No such means to prevent the floor from rising was used in this work; its security and stability are provided for by other ap-

NOTABLE SUSPENSION BRIDGES, 1855-1867

pliances. The rock underneath the Niagara bridge afforded a very cheap mode of anchoring; it would have been a great oversight on my part not to avail myself of under-floor stays in such a favorable locality. But in the Ohio River no such appendages were admissible.

“The general plan which I have always pursued in my works insures, by the heavy contraction of the cables in the center of the span, great lateral stability at this point. The larger and heavier the span, the greater will be its comparative stability at the center. Vertical stability in the center is also insured in large spans by the weight of the structure. But not so between the center and the towers. In consequence of the equilibrating tendency of the two opposite halves, vertical oscillations occur easier, and the great length of suspenders, acting like pendulums, promotes lateral displacements. These tendencies have to be met, and are thoroughly overcome in the Ohio bridge by an effective system of stays. The very careless manner in which stays have been attempted heretofore is a violation of the principle involved. Their arrangement in this bridge not only insures their own freedom from oscillation, but renders them fully effective by the uninterrupted preservation of their lines.

“Aside from simply stiffening the floor, the stays are rendering another and very important service; they effectually insure equilibrium between the main and half spans. Without stays the balance between adjoining spans would sometimes be greatly disturbed by unequal loads. The large crowds of many thousands of people which frequently cover the floor from one end to the other, are occasionally very unevenly distributed, but they have never produced the slightest injurious effect upon the statical condition of this work.”

He adds:

“Great doubts are yet entertained by many engineers, par-

THE ROEBLINGS

ticularly in Europe, in regard to the fitness and safety of suspension bridges for railway purposes. By an additional expenditure of \$50,000 and a railroad track laid down in the center of the floor, the Ohio bridge could have been made serviceable for the passage of locomotives and trains at the highest speed. Let any person who doubts this, observe the very slight tremor which is produced in this bridge by a long line of heavily loaded teams, frequently ten in a row, and he will readily understand that but a small addition of rigidity is wanted in order to pass railroad trains."

DIMENSIONS OF CINCINNATI-COVINGTON BRIDGE

The principal dimensions of this bridge are: Main span, from center to center of towers, 1,057 feet. Side spans, from abutment to center of tower, 281 feet. Total length between abutments, 1,619 feet. Elevation of floor above low water at tower, 91 feet. Elevation of floor above low water at center, 103 feet. Length of Cincinnati approach from Front Street to abutment, 341 feet. Length of Covington approach from Second Street to abutment, 292 feet. Total length, including approaches, 2,252 feet. Number of cables, 2, each $12 \frac{1}{3}$ inches in diameter. Number 9 wires in each cable, 5,200. Ultimate strength of one cable, 4,212 tons. Weight of main span between towers, 1,500 tons. Number of stays in main span, 76; strength of each, 90 tons. Weight of main span between towers, as far as supported by cables, 1,300 tons. Deflection of cables in main span, 89 feet. Permanent tension to strength, one-eighth. Ordinary working tension to strength, one-seventh. Maximum tension to strength, one-sixth. Section of each anchor chain in square inches, 190. Area of each foundation in square feet, 8,250. Cubic contents of masonry of each tower, 400,000 feet.

NOTABLE SUSPENSION BRIDGES, 1855-1867

THE ALLEGHENY BRIDGE AT PITTSBURGH COMPLETED, 1860

During the delay of the Cincinnati bridge, arrangements were made to proceed with the erection of still another suspension bridge at Pittsburgh, to take the place of the old wooden Allegheny Bridge, built in 1818, and no longer safe. The removal of the old structure and construction of the new permanent work, including the building of the three new piers and two anchorages, required three years, from 1857 to 1860. The total length of this bridge is 1,030 feet, divided into two spans of 344 feet each, and two side spans of 171 feet each. The floor has a width of 40 feet, including two sidewalks, 10 feet wide. The framework of the superstructure is composed essentially of iron girders, with a flooring of wood. Ornamental open towers of cast iron support the cables, which are four in number, two of 7 inches in diameter, attached to the floor between the sidewalks and carriageway, and two of 4 inches in diameter, attached to the ends of the floor beams; in addition to the cables, there is an effective system of stays.

A TRIBUTE TO ROEBLING'S SCIENTIFIC KNOWLEDGE

Mr. Charles B. Stuart, in his book previously quoted from, pays the following tribute to Mr. Roebling's scientific knowledge and the accuracy of his reasoning:

"Mr. Roebling's reasoning was always clear, simple, and explicit, and sustained by philosophical and scientific facts. He took nothing for granted. His arguments were drawn from his store of scientific knowledge, with a mathematical accuracy and fitness that carried with them a conviction of truth. He was impatient at captious opposition to his projects, but always courted a discussion of his plans by those who brought sound theoretical or practical opposition to his views. In a report made by him for a suspension bridge at Cincinnati as early as

THE ROEBLINGS

1846, and to which there was much opposition from those interested in river navigation, he says in effect: 'I have no fears of those who *honestly* believe the bridge to be injurious to the navigation; the opposition of cavillers I most dread.' "

The Cincinnati-Covington Bridge at the time of its completion was the longest wire-cable suspension bridge in the world, but was soon to be surpassed by the great Brooklyn Bridge, for which Mr. Roebling prepared the original plans and specifications, but owing to his death in 1869 it was built and finished by his son, Washington A. Roebling.

AUTHORITIES FOR THIS CHAPTER

Henry Grattan Tyrrell, C.E., *History of Bridge Engineering*, published by the author, Chicago, 1911.

Charles B. Stuart, C.E., *Lives and Works of Civil and Military Engineers*, published by D. Van Nostrand, New York, 1871.

John A. Roebling, C.E., "Memoir of Niagara Falls Suspension and Niagara Falls International Bridge," 22 illustrations, in *Papers and Practical Illustrations of Public Works of Recent Construction, Both British and American*. John Weale, London, 1856.

Manuscript letters of John A. Roebling, 1848-1867, in possession of John A. Roebling's Sons Company.

Report of John A. Roebling to the directors of the Cincinnati-Covington Bridge Company, 1867.

Proceedings of the Engineers' Society of Western Pennsylvania for 1895, "Pittsburgh and Allegheny Bridge."

John A. Roebling, *Long and Short Span Bridges*. 1869. D. Van Nostrand, New York. Published after his death by his son, Washington A. Roebling.

CHAPTER VII

THE BROOKLYN BRIDGE PROJECTED, 1867

Tragic Death of John A. Roebling, 1869—Résumé of Professional and Business Achievements

AS FAR back as the beginning of the last century the project to connect the city of New York with the opposite shore of Long Island by a bridge engaged á measure of public attention. A recent writer in the *New York Times* has been at pains to collect some references bearing upon the matter. He quotes General Jeremiah Johnson, writing in his notebook previous to 1800, as stating his conviction that the idea of spanning the East River was a practical scheme. His words are:

“It has been suggested that a bridge be constructed across the East River to New York. This idea has been treated as chimerical from the very magnitude of the design, but whosoever takes it into their serious consideration will find more weight in the practicability of the scheme than at first sight he imagined. A plan has already been laid down on paper, and a gentleman of acknowledged ability and good sense has observed that he would engage to erect it in two years’ time.”

The *Times* writer also mentions in his article Thomas Pope, writing about 1811, “as favorably inclined to the idea,” and General Joseph G. Swift in 1836 as making the bold suggestion that “a dike be built instead of a bridge.” He quotes Prime, the New York historian, as observing about the middle of the 1840’s that “the erection of a bridge between New York and Brooklyn had become the great topic of conversation,” but, contemplating the good ferry service at that time, he wondered

THE ROEBLINGS

“who would think of crossing on a bridge if one stood in his way.”

John A. Roebling's thoughts were directed to the project certainly as early as 1853, probably occasioned by the fact that he himself was compelled to spend several uncomfortable hours on a ferry boat in a winter day of that year when the river was choked with ice.

ROEBLING THE FIRST TO SUGGEST THE FEASIBILITY OF THE BRIDGE, 1857

Under date June 19, 1857, Mr. Roebling addressed a letter to Abram S. Hewitt on the subject, to which letter Mr. Hewitt called attention in the course of the speech which he made on the occasion of the ceremonies held in connection with the opening of the bridge, May 24, 1883. The speaker observed that, so far as he was aware, “Mr. Roebling was the first engineer to suggest the feasibility of a bridge between the two cities, so constructed as to preserve unimpaired the freedom of navigation. . . . This letter,” he declared, “was the first step towards the construction of the work, which, however, came about in a manner different from his [Roebling's] expectations and was finally completed on a plan more extensive than he had ventured to describe.” He added that: “When Roebling suggested the bridge over the East River, his ideas were limited to the demands of the time and controlled by the necessity for a profitable investment. He had no expectation that the two cities would embark in the enterprise. Indeed, in one of his letters so late as April 14, 1860, he says: ‘As to the corporations of New York and Brooklyn undertaking the job, no such hope may be entertained in our time.’ ” Mr. Hewitt sent the letter of 1857 for publication to the *Journal of Commerce* where it subsequently appeared, and as he observed, “it attracted great

THE BROOKLYN BRIDGE PROJECTED, 1867

attention because it came from an engineer who had already demonstrated by successfully building suspension bridges that he spoke with the voice of experience and authority."

The initiative looking to the construction of a bridge originated not in New York City, nor from official sources, but in Brooklyn and from a private association of citizens of that city, of whom the leader was William C. Kingsley, who, as far back as 1865, had conceived the project and, after consulting prominent engineers and receiving assurance that the scheme was feasible, had succeeded in interesting others in it.

A strong impetus was given to the enterprise by the arctic conditions prevailing in the East River during the memorable winter of 1866-1867. There were days during that period when the river was so choked with ice that passengers by rail from Albany completed their journey to New York in less time than it took the unhappy voyagers by ferry boat from Brooklyn to reach their destination in Manhattan. Thus a popular and vehement demand for the immediate construction of a bridge spontaneously arose and the newspapers took up the matter and added their approval to the enterprise.

CHARTER FOR BRIDGE GRANTED, 1867

Application for a charter of a corporation of private citizens, empowered to raise the funds and erect the bridge, was made to the New York Legislature and on April 16, 1867, an act was passed incorporating The New York Bridge Company and giving authority to build a bridge over the East River between the cities of New York and Brooklyn.

Parenthetically, it may be stated that, as the project advanced, it came to be universally felt that a public work of such magnitude could not be satisfactorily left in the hands of a private corporation and therefore an act was passed by the Legis-

THE ROEBLINGS

lature seven years later, June 4, 1874, making the bridge a publicly owned enterprise, the whole cost to be defrayed by the two cities, Brooklyn paying two-thirds of the cost and New York one-third. The original money invested by private parties was returned to them and their title was extinguished. The same engineers were retained and also the chief working numbers of the directory, so the work remained a unit from first to last.

The charter of 1867 fixed the Brooklyn terminus at the junction of Main and Fulton Streets, but allowed the New York terminus to be at or below Chatham Square, though not south of the junction of Chatham and Nassau Streets. The charter originally and provisionally fixed the capital at \$5,000,000, with power to increase the amount, and gave the cities of New York and Brooklyn authority to subscribe to the capital stock of the company such amounts as their Common Councils respectively should determine. It was then felt that this joining of public with private capital was a wise provision since it would be a double guarantee that the enterprise would be effectively carried on, since neither public nor private capital alone could be depended upon to carry the work forward upon safe and economical lines. One interest would serve as a check to the other and above all the men who had invested their own money would be zealous to see that political corruption had no opportunity to do its evil work.

JOHN A. ROEBLING APPOINTED CHIEF ENGINEER, 1867

On the organization of the company in May 1867, one month after its incorporation had been effected, John A. Roebling was appointed chief engineer, May 23, 1867. At that time Mr. Roebling had about completed the Cincinnati-Covington Bridge which up to then was the longest suspension bridge in the United States. The fame of the engineer was now at its

zenith and he was universally regarded as the foremost exponent of wire-cable suspension bridges in America, if not in the world. The company therefore felt that in selecting him they would have made no mistake.

In September of the same year, an incredibly short space of time for the work involved, he presented the preliminary plans, surveys and estimates. His original estimate of the cost of the structure was \$7,000,000, exclusive of the land required for the approaches, and he placed the time necessary for building the bridge as five years. In his original plan and estimate Mr. Roebling contemplated approaches constructed of light iron girders, or trestle work supported by pillars of brick or stone, but as later agreed upon it was concluded to build entirely of granite and brick, and to provide a series of masonry archways with a view to their being rented as warehouses. This, of course, increased the expense. Mr. Roebling claimed that the cost of these improvements should not be charged against the bridge and it was accordingly omitted by him. Additional expenses were subsequently incurred in building the stations at both terminals to provide for passengers on the elevated railway structures and for sundry preliminary costs connected with general superintendence, for interest and discount on city bonds, legal, medical and other incidental disbursements. Moreover, the failure of the City of New York to provide promptly its proportion of the necessary funds added an enormous increase to the total cost which it is difficult to estimate.

In the speech of Mr. Hewitt, previously quoted from, he touched upon the ultimate cost of the bridge and declared that the popular impression that through political thievery the cost had far exceeded the original estimates was wholly unfounded:

“I know that to many I make a startling announcement when I state the incontrovertible fact that no money was ever

THE ROEBLINGS

stolen from the funds of the bridge; that the whole has been honestly expended; that the estimates for construction have not been materially exceeded; and that the excess of costs over the estimates is due to the purchase of lands which were never included in the estimates; to interest paid on the city's subscriptions; to the cost of additional height and breadth of the bridge; and the increase of strength rendered necessary by a better comprehension of the volume of traffic between the two cities. The items covered by the original estimate of \$7,000,000 have thus been raised to \$9,000,000, so that \$2,000,000 represents the addition to the original estimates."

He concludes:

"The statement I have made is due to the memory not only of John A. Roebling but also to Henry C. Murphy, that great man who devoted his last years to this enterprise; and who, having like Moses led the people through the toilsome way, was permitted only to look, but not to enter upon the promised land. This testimony is due also to the living trustees and to the engineers who have controlled and directed this large expenditure in the public service."

In regard to the ring of corrupt officials which dominated the City of New York about this period, Mr. Hewitt declared that: "The government fell into the hands of a band of thieves, who engaged in a series of great and beneficial public works, not for the good they might do, but for the opportunity which they would afford to rob the public treasury. . . . The bridge was commenced but the Ring was driven into exile by the force of public indignation. . . . The collapse of the Ring brought the work on the bridge to a standstill. It was a timely event. The patriotic New Yorker might well have exclaimed, just before the great deliverance, in the words of the Consul of ancient Rome in Macaulay's stirring poem:

THE BROOKLYN BRIDGE PROJECTED, 1867

“And if they once may win the bridge,
What hope to save the town?”

A BOARD OF CONSULTING ENGINEERS APPOINTED AT ROEBLING'S SUGGESTION

After Mr. Roebling's preliminary report of 1867 had been accepted by the bridge trustees and he was ordered to proceed with the work, at his own instance and with the approval of the trustees, a board of consulting engineers, composed of some of the most eminent men in their profession, was appointed in March 1869, to go over the plans and render judgment upon them. The board made its report in May of that year, stating that they had been informed by Mr. Roebling, that “in view of the magnitude of the undertaking and the large interests connected therewith, in the Cities of New York and Brooklyn, he had suggested to the directors that it was right and proper, before going forward with the work, that his plans should be subjected to the careful scrutiny of a board of engineers, convened for the purpose, in order that, if his plans received their approval, the enterprise would stand before the public sustained by their professional judgment and would not rest solely on the judgment of one single engineer.”

The board reported that “they had completely examined the plans and the investigations of the combinations and proportions proposed for the service required, and had deemed it an appropriate part of their duty to examine the structures of the same general character erected by Mr. Roebling, across the Monongahela and Allegheny at Pittsburgh in 1846 and 1854 (1859) and the Niagara, at Niagara Falls in 1854, and across the Ohio at Cincinnati in 1867. They had thus had under their eye and personal examination the successive steps, which, beginning with a span of 200 feet in 1846, was followed

THE ROEBLINGS

by a span of 822 feet in 1854 and by a span of 1057 feet in 1867, all standing this day, a practical demonstration of the soundness of the principles and proportions on which these structures have been erected and rendering unnecessary, at least for spans of 1000 feet, any other demonstration, and affording the best source of information as to the practicability of taking another step in a span of 1600 feet."

Their conclusion was "that it is beyond doubt entirely practicable to erect a steel wire suspension bridge of 1600 feet span, 135 feet elevation across the East River, in accordance with the plans of Mr. Roebling and that such structure will have all the strength and durability that should attend the permanent connection by a bridge of the Cities of New York and Brooklyn."

The report closes with some references to technical points and suggestions as to the precautions necessary to be taken to preserve the durability of the material used.

A commission of three United States Army engineers was appointed by the War Department to report upon the feasibility of the work and particularly as to whether or not the bridge would be an obstruction to navigation, and they made the single requirement that the height of the bridge at the center above high water should be increased by five feet, that is, from 130 feet to 135 feet.

Probably seldom or never in a public work of such magnitude have the recognized experts so unanimously approved the plans exactly as they had issued from the mind of the one man selected to carry them to completion. Professional jealousy, if not the mere desire to display the possession of a critical faculty, commonly intervenes to prevent complete endorsement.

THE BROOKLYN BRIDGE PROJECTED, 1867

SUDDEN DEATH OF JOHN A. ROEBLING, 1869

Thus the plans for the bridge were perfected, accepted and approved in the spring of 1869, the preliminary surveys had been made and the actual work was about to begin, when the sudden death of John A. Roebling in July of that year brought his connection with the enterprise to a tragic conclusion. Henceforth the history of the Brooklyn Bridge until its completion in 1883 is associated with his son and successor, Washington A. Roebling under whose name the subsequent history of the bridge will be continued.

As the initiative in this great work resulted in the death of the father so likewise its continuance was responsible for the permanent disablement of the son. In fatal succession both fell victims to the intense zeal and devotion which alike animated them in the pursuance of a project which had enlisted the full energies of their manhood.

The accident which resulted in the death of Mr. Roebling occurred on June 28, 1869. He was engaged at the time in taking observations for the projected bridge across the East River, at a point on the Brooklyn side where a double row of piles run along the river front. The front row was surmounted by a plank which lapped over when pressed against. Mr. Roebling was standing on the back row and was so much engrossed in his work that he did not notice a boat approaching. When the boat touched, the front piles were pushed back and Mr. Roebling's foot was caught and several of his toes cut off. He was taken to the house occupied by his son Washington A. Roebling who was then living at 137 Hicks Street, Brooklyn, so that he could be in close proximity to his work. The symptoms were not at first alarming, but tetanus afterwards set in with fatal effect and he died on Thursday, July 22, at about 6 o'clock a.m.

Even on his death-bed his inventive mind was still at work.

THE ROEBLINGS

The day before his death he projected and made a drawing of an apparatus for lifting himself in bed. This plan he explained to his attendant and nephew, Edmund Riedel, but before it could be used he had passed away.

The funeral was held on the following Sunday afternoon at 1:30 from the Roebling home in Trenton. The interment was in Mercer Cemetery, Trenton. Several years afterwards his remains were exhumed and deposited in the Roebling lot in Riverview Cemetery where they now repose, together with those of his first wife Johanna Herting Roebling and two infant children who had predeceased him. A fine granite monument marks the site.

The funeral was attended by a vast concourse of people, including the mayor and common council, the members of the Board of Trade of the city, prominent citizens, representatives of the organizations of which Mr. Roebling was a member, several hundred workers in the various iron mills, with all the employees of the Roebling plant. From New York came a special train with five carloads of friends and acquaintances, including the directors of the New York Bridge Company in a body, and other influential citizens from New York and Brooklyn. The funeral procession was over a mile in length.

Besides the local newspaper notices, obituary sketches and editorials appeared in the Brooklyn and New York dailies, and many trade and scientific journals. All lauded Roebling's achievements as an engineer, and expressed the sense of loss which the community and the country had suffered through his death.

TRIBUTES TO HIS GENIUS

His contemporary and a competent authority, Charles B. Stuart, author of *Lives of Civil and Military Engineers*, thus

THE BROOKLYN BRIDGE PROJECTED, 1867

sums up his character in the biographical sketch which appears in his book under the title "John A. Roebling."

"One of his strongest moral traits was his power of will, not a will that was stubborn, but a certain spirit, tenacity of purpose, and confident reliance upon self, that was free of conceit; an instinctive faith in the resources of his art that no force of circumstance could divert him from carrying into effect a project once matured in his mind. His skill as an engineer was not surpassed by his exact probity. He held it 'to be the duty of an engineer, when charged with the designs of public works, to report previous to their execution fairly, accurately, and candidly,' and that 'honesty of design and execution, next to knowledge and experience, most surely guarantees professional reputation.' Before entering upon any important work, he always demonstrated to the most minute detail its practicability, to his own mind at least, by scientific experiment and critical test; and when his own judgment was assured, no opposition, sarcasm, or pretended experience, could divert him from consummating his designs, and in his own way.

"His brain was fertile in expedients to meet and overcome any incidental impediment that might arise in the course of construction of any work."

Another competent to speak of his career and achievements wrote:

"John A. Roebling came to America a stranger to its life and customs, without influential friends, and with little capital other than character, energy and courage. He began the manufacture of an unknown article, for which he created a market, aided in so doing the development of the nation's resources, and laying the foundation of one of the world's great industries. He met a condition arising from the growth of his adopted country,

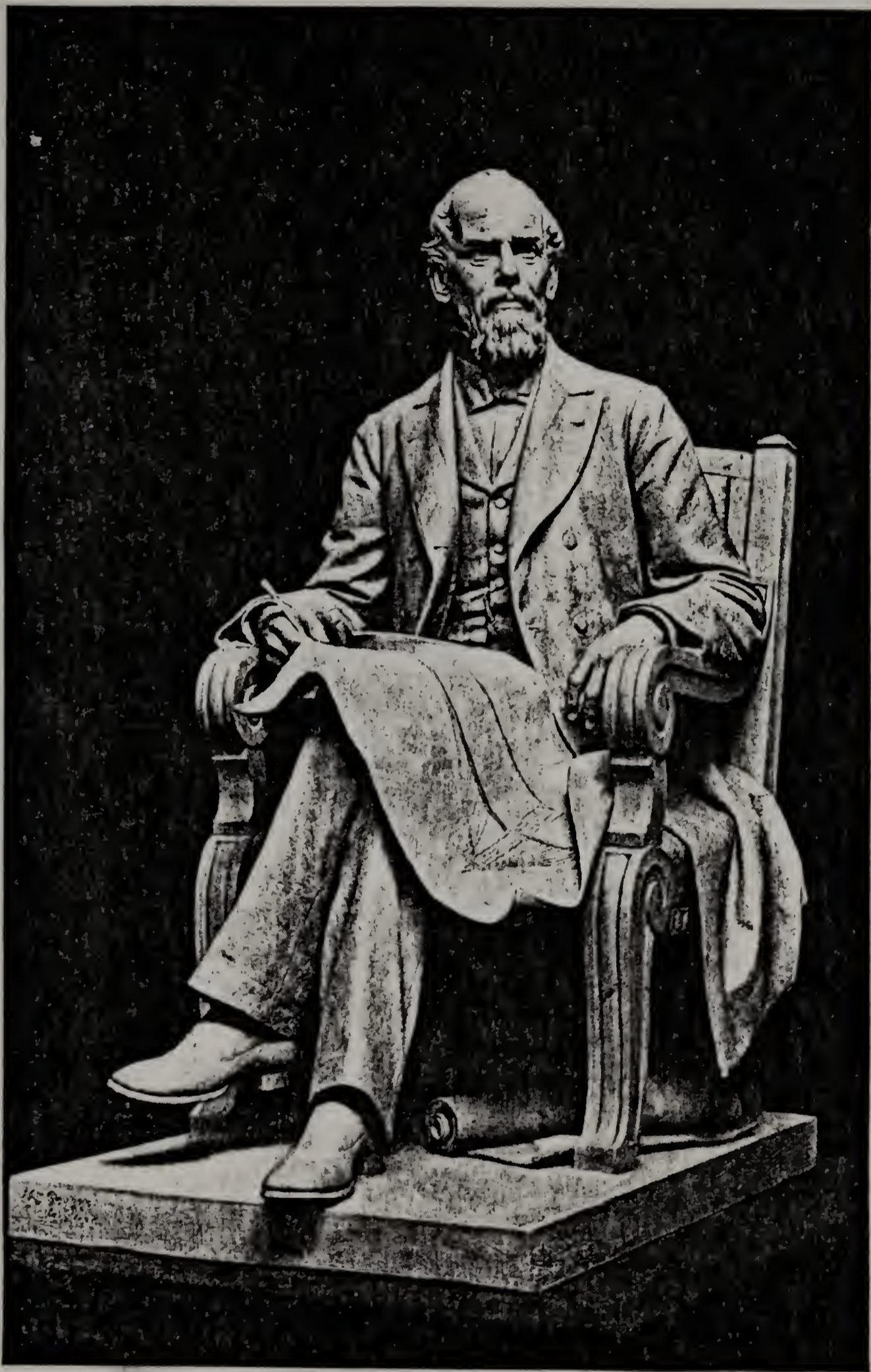
THE ROEBLINGS

by proposing to carry new highways across rivers upon bridges, the like of which had not been known before.

“There arose about him a chorus of protest, voiced by engineers more eminent than he, who denounced his plan as visionary and impracticable. With courage undaunted, a persistence not to be repelled, he insisted that he had discovered a principle of mechanics worthy of acceptance, and silenced his critics by building those great bridges which stand as beautiful and imposing monuments to his memory.”

Thirty-nine years after the death of John A. Roebling a bronze monument was erected to his memory in Cadwalader Park, Trenton. The funds were contributed by popular subscription, supplemented by contributions from his sons. The ceremonies connected with the unveiling of the monument were held June 30, 1908, and were attended by over fifteen thousand people, among whom were the Governor of New Jersey, the two United States Senators and other distinguished guests. Throughout the city there was a general display of flags and the occasion was officially recognized by the closing of the City Hall and Court House at noon, and the attendance in a body of the city and county officials. The City of Muhlhausen, Germany, where Mr. Roebling was born, sent an artistic bronze wreath in honor of the memory of its famous son. Addresses were made by the Hon. Edward C. Stokes, former Governor of New Jersey, and Henry D. Estabrook of New York, general counsel of the Western Union Telegraph Company, whose daughter Blanche was the wife of Karl G. Roebling, a grandson of John A. Roebling. Prior to the ceremonies 6500 employees of the Roebling Company headed by the sons and grandsons of John A. Roebling marched from the works, through the streets of Trenton to Cadwalader Park.

The Roebling Press subsequently published a full account



*The Bronze Statue of John August Roebling Erected in Cadwalader Park,
Trenton, in 1908*



*Edmund Riedel, in Charge of the Roebling Rope Shop for
Fifty-seven Years*



*Julius Riedel, a Waterloo Veteran, Uncle of the Roebling
Brothers*

THE BROOKLYN BRIDGE PROJECTED, 1867

of the proceedings with the text of the speeches made on the occasion, supplemented by extracts from newspaper comments made at the time.

The monument was unveiled by Miss Emily Roebling, afterwards Mrs. Richard McCall Cadwalader, eldest daughter of Charles G. Roebling.

The inscription on the face of the monument reads:

TO
JOHN A. ROEBLING, CIVIL ENGINEER
DESIGNER AND BUILDER OF MANY SUSPENSION BRIDGES
FOUNDER OF TRENTON'S GREATEST INDUSTRY
AN ENERGETIC WORKER, INVENTOR AND MAN OF AFFAIRS
DEVOTED TO HIS ADOPTED COUNTRY
IN WHOSE PROGRESS HE HAD UNSWERVING FAITH
A PATRON OF ART AND SCIENCES
AND BENEFACTOR OF MANKIND
THIS MONUMENT IS ERECTED BY THE CITIZENS OF TRENTON
AND HIS SONS IN THE YEAR 1907

THE ROEBLING MONUMENT

The monument has a total height of 15 feet 7 inches. This is exclusive of the concrete base, which is built 4 feet 6 inches underground. The stonework supporting the statue is 9 feet high and the statue measures 6 feet 7 inches. The figure is modelled in a sitting position. Had it been cast in a standing posture, it would have reached a height of exactly 8 feet. The statue is made of bronze, cast from a clay model designed by William Couper, the sculptor. The pedestal is built of red Swedish granite.

On the right side of this granite pedestal is a bronze panel containing a reproduction in relief of the first railroad suspen-

THE ROEBLINGS

sion bridge built over the Niagara. On the left side is another panel containing a replica, also in relief, of the Brooklyn Bridge, designed by Mr. Roebling.

Commenting on the statue and extolling its life-likeness, the orator of the day, Mr. Estabrook, in his opening remarks said:

“I am expected by those having these ceremonies in charge to translate into words what the sculptor has so admirably expressed in bronze, namely the type and quality, the idiosyncrasy of your famous fellow townsman. But words are too plastic for such a task. As if his nature had been subdued to what it worked in, the Iron Master of Trenton was a man of iron. Iron was in his blood, and sometimes entered his very soul; a man of iron with the virtues of iron and peccancies of iron to his account, and John A. Roebling as he was, as you knew him, head bared to the blows of fortune, or the storms of heaven, eyes fixed unwaveringly on whatever object he had in hand, poised, confident, unyielding, imperious and proud—John A. Roebling is there—seated forever on yonder pedestal.”

John A. Roebling was a rich man when he died, a very rich man for those days. His total estate was valued at about \$1,200,000, by far the most of it accumulated in the last twenty years of his life. He left the business to his four sons and requested them to continue it under the firm name “John A. Roebling’s Sons,” and such it has remained to this day. In 1876 when the business was incorporated the word company was added. Besides the investment in the plant, his estate represented large holdings in the various bridge companies and other works with which he had been associated.

STATUS OF THE INDUSTRY AT THE DEATH OF JOHN A. ROEBLING, 1870

The Census Report for 1870 gives the particulars as to the state of the industry when he died.

THE BROOKLYN BRIDGE PROJECTED, 1867

John A. Roebling's Sons—Wire Rope

Steam Power: 250 Horsepower

75 Males Employed above 16 Years Old

10 Children and Youths

Total Amount of Wages Paid for Year: \$52,000

Number of Months in Active Operation: 12

Materials:

Coal, 2,500 Tons, \$17,500

Lumber, 50,000 Feet, \$1,250

Iron, 800 Tons, \$88,000

Acids, 20,000, \$800

Production: 700 Tons; Wire Rope, \$250,000.

JOHN A. ROEBLING'S WILL AND BENEFACTIONS

His will, which is an interesting and characteristic document, was made in 1867. To his four sons, Washington A., Ferdinand W., Charles G., and Edmund, the two latter being minors at the time, he left the factory buildings, fixtures and machinery together with the land they occupied to hold as equal tenants in common. He fixed the value of these at \$150,000. After the payment of legacies to certain charitable institutions and relatives, including the sum of \$20,000 to his faithful superintendent Charles Swan—the whole amounting to over \$100,000—he bequeathed to each of his seven children by his first wife, and to his second wife Lucia W. Roebling, née Cooper, whom he had married in 1867, one-eighth of the residue of his personal estate, deducting however from each child's share the money respectively advanced to them in his lifetime, and from his sons' shares the value of the industrial plant of which they came in possession.

Mr. Roebling's private ledger shows that he had kept an exact account of the expenditures made on behalf of his chil-

THE ROEBLINGS

dren, down to minute details. Among the legacies were \$30,000 to the Union Industrial Home of Trenton, the same amount to the Widows' and Single Women's Home of Trenton and \$30,000 to be divided between the Pittsburgh Infirmary, the Orphans' Farm School at Zelienople, and the Wartburgh Orphans' Farm School near Mount Vernon, New York.

He expressed the wish that his sons should associate with them, as a partner in the business, his present manager, Charles Swan.

JOHN A. ROEBLING'S SONS COMPANY INCORPORATED, 1876

To anticipate events a little, it might be stated that after the death of John A. Roebling, up to 1876 the business was continued under the firm name of John A. Roebling's Sons, of which the members were his four sons. In 1876 it was determined to incorporate the firm as John A. Roebling's Sons Company to carry on the business heretofore conducted as a partnership. The company was organized January 13, 1876. Washington A. Roebling was elected president; Charles G. Roebling, vice-president; and Ferdinand W. Roebling, secretary and treasurer. Charles Swan was appointed general superintendent; William H. Gandy, chief clerk and bookkeeper, and Edmund Roebling, first assistant bookkeeper. Ferdinand W. Roebling and Charles G. Roebling were the executive committee. The total assets of the company when business commenced were \$893,451.96, of which \$500,000 represented capital stock, consisting of 1,000 shares at \$500 each. The capital stock was divided as follows:

Washington A. Roebling	300 shares
Ferdinand W. Roebling	300 "
Charles G. Roebling	300 "
Edmund Roebling	100 "

THE BROOKLYN BRIDGE PROJECTED, 1867

The youngest son, Edmund, born January 1, 1854, in Trenton, did not long remain in the business, except as a stockholder. His health was poor and he preferred to be relieved of all active duties. He spent considerable time in foreign travel and for many years lived in semi-retirement in New York City. He was a great reader and interested in world events. He never married. He died in New York City December 21, 1930. His estate, which amounted to some \$14,000,000, was divided among his twelve nephews and nieces.

Of the nine children born to John A. Roebling and Johanna Herting Roebling all but two survived their father. Besides his four sons mentioned above, there were three daughters, all born in Saxonburg: Laura, June 24, 1840, married to Anton Gottlieb Methfessel; Elvira, May 22, 1844, married to John H. Stewart, and Josephine, March 22, 1847, married to Charles Henry Jarvis, a distinguished pianist, a tablet to whose memory was erected many years ago in the Academy of Music, Philadelphia. All are now dead except Mrs. Jarvis.

It may here be observed that the Roebling Company has always been a closed corporation in which the shares have been held solely by members of the family, and for many years these were limited to the males bearing the Roebling name. Only in recent times, due to the settlement of estates, have female heirs become owners. No outsiders have been admitted, except in a few instances when it was necessary for business purposes for such to hold qualifying shares.

A RESUME OF THE INDUSTRY, BY WASHINGTON A. ROEBLING

Colonel Roebling in his exhaustive account of fifty years' progress of the business, written in 1919, thus sums up the general conditions as they existed at the time of his father's death, 1869.

THE ROEBLINGS

“Much progress was made during the twenty years of Swan’s administration. A rolling mill was built next to the canal, so as to roll our own rods from Swedish iron bars, which had been previously rolled by Cooper & Hewitt. This was a small affair compared with those built by Charles later on. New boilers were put in and anthracite coal used in the heating furnace. The wire mill was enlarged, a double annealing pot devised by John A. Roebling. It was not until 1862 that the rope walk was permanently abandoned. But before that time Mr. Roebling had designed vertical strand machines and vertical rope-laying machines which were erected in the building now known as the old rope shop. Some of these machines are still in use, about as good as new. A horizontal fast-running ‘Smith’ strand machine which I had brought over from England was, however, frowned upon by John A. Roebling on the ground that it weakened and injured the wire. After he died this was one of the first things done.

“Much experimenting was carried on in the direction of cleaning, annealing and preparing wire for drawing. One of the great discoveries consisted in avoiding brittleness of fresh-drawn wire, which heretofore had to lie in storage for six months up aloft before it became fit for use. A London chemist had discovered that hydrogen became occluded in the pores of the wire when the scale had been eaten off by dilute sulphuric acid. Then someone else discovered that by baking the wire at a temperature of 700 degrees in a sort of bake-oven all the hydrogen was driven out in twenty-four hours and the wire lost its brittleness. A further progress consisted in mixing muriatic acid with the vitriol, the latter only a third or fourth part, so that the amount of occluded hydrogen was very much reduced. Attempts to use alkalies for cleaning failed. Overman tried that in 1851.

THE BROOKLYN BRIDGE PROJECTED, 1867

“Mr. Swan’s duties constantly increased, being further complicated by having to attend to bookkeeping, signing checks, etc. He also built the new house, now occupied as an office (after John A. Roebling’s plans)—occupied in 1856. When the building, then called the rope shop, was filled with machinery, Mr. Roebling said it was no longer necessary to build more machinery and that the factory was big enough for all business. How much he was mistaken is shown by its present size.

“The American elevator was then beginning its great career—it depended for success on a flexible wire rope. Attempts were made to make them on the rope walk, but the wire was too fine and it failed. That required fast-running small machinery. Its immense expansion was not dreamed of at that time. We could not even draw the wire—there was not a small wire block on the place. All that had to be learned.

“Such was the situation when John A. Roebling died in 1869. Charles was still at Troy, and Ferdinand and Swan were running the business, with my occasional help. Ferdinand had been in the office several years looking after the correspondence, orders and driving Swan, who was getting old and conservative. The work was getting too much for him. He was rather glad when the new force arrived. But Swan had grown up with John A. and not with these younger men. It was not long before a little friction developed and it grew and grew. It was not exactly jealousy, but they could not look upon Swan as an equal. This state of affairs lasted some time. After three years of it Swan left suddenly; he could not stand it any longer. His health was breaking; a few years later he retired permanently. Had all this occurred today he would have been pensioned off earlier in recognition of his long and valuable services.”

THE ROEBLINGS

As a matter of fact Swan, soon after John A. Roebling's death, for reasons given above by the Colonel, severed his connection with the firm, but after an interval was persuaded to return, the brothers finding that his knowledge and experience at that time were essential to the successful progress of the industry. Favorable terms were offered him and he accordingly resumed his old place as superintendent. After his retirement he continued to live in Trenton in the enjoyment of his well earned leisure. He died in Trenton on January 28, 1897, in the seventy-fifth year of his age. He left one son, Charles Henry Swan, who married a daughter of Edward H. Stokes, a well known Trentonian, who was the owner of Bloomsbury Court, the mansion built in 1719 by William Trent, for whom the city was named, and the oldest building standing in Trenton today. Quite recently his son, Edward Ansley Stokes, made a gift of this property to the city, which it is proposed to use as a branch library. A grandson of the original Charles Swan and a son of Charles Henry, Charles Edward Swan, is now a business man in Trenton.

ATTITUDE OF EMPLOYEES TO COMPANY

Perhaps it may here be noted that the Roeblings seem to possess the faculty of retaining the services of their capable employees for long periods. There would appear to have grown up an esprit de corps among the chief workers, clerical and mechanical, that binds them into a loyal group, devoted to the company's interests. It is not perhaps that the scale of compensation is higher for the same class of work than in similar establishments, but rather that there is a sentimental feeling, bordering on an affection for the company, which makes them loath to sever their association with it, even when an opportunity presents itself to better their financial state. Under the

THE BROOKLYN BRIDGE PROJECTED, 1867

patriarchal rule of John A. Roebling the skilled workers were regarded almost as members of his family and even in later days under his sons much the same spirit prevailed. There were and still are men in the Roebling employ who have served for thirty, forty and even fifty years.

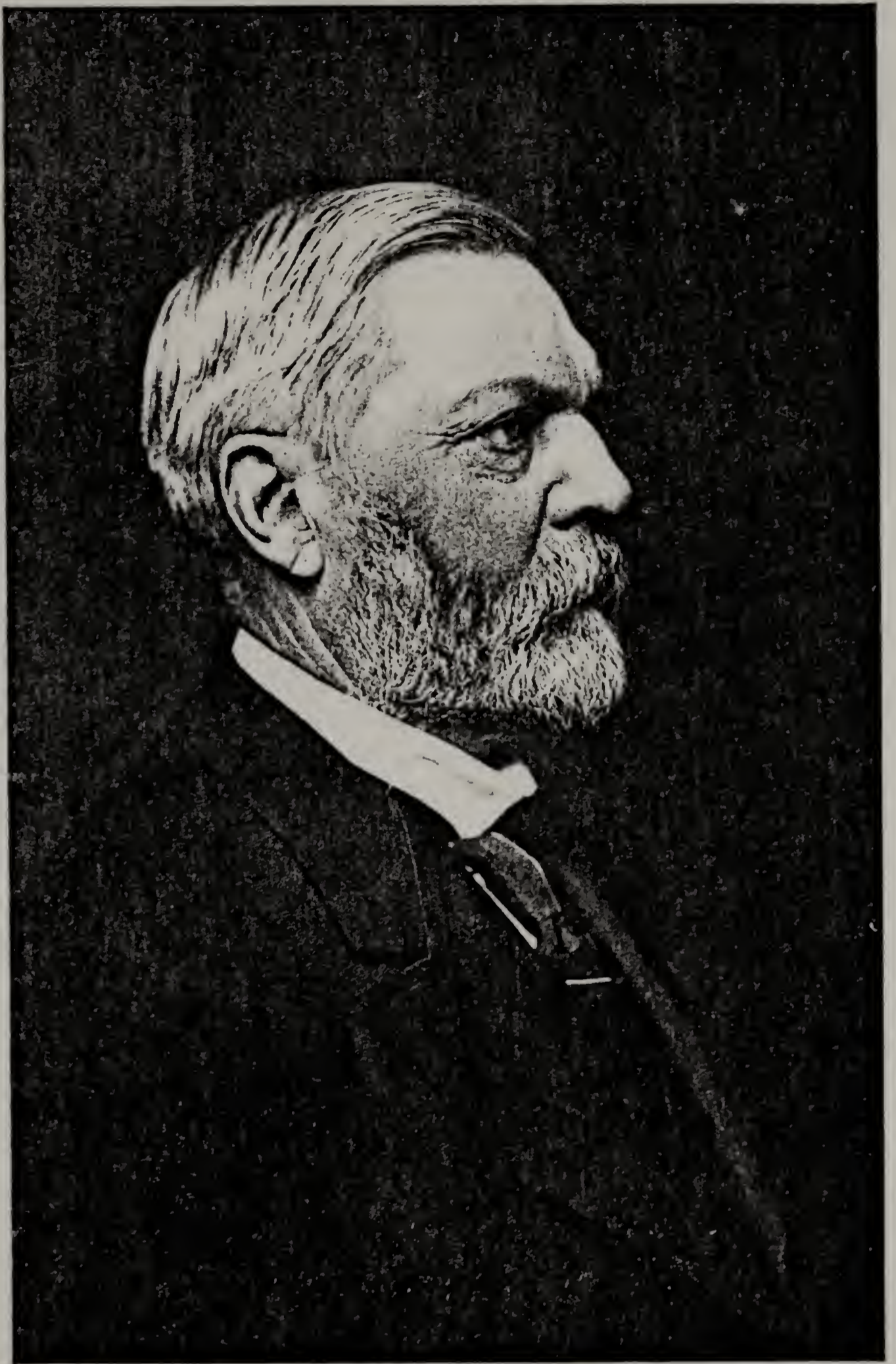
While the Roeblings have always observed the open shop they have never made any distinction between union and non-union men. All were alike free to belong to any association they might elect. All the company asked was faithful service and no interference with the prerogatives of the company as their employer, nor any coercion exercised upon their fellow workmen. Naturally as the number of those employed in the course of years tended to run into thousands and embraced all nationalities, there have been some strikes, but as it came to be known that the company having once made what it regarded as a just decision would not withdraw from it under any threats whatsoever, few of the strikes have been prolonged ones.

A full list of the authorities relating to the Brooklyn Bridge will be found at the end of a subsequent chapter where the story of the bridge is continued.

PART II

WASHINGTON AUGUSTUS ROEBLING

1837-1926



Colonel Washington A. Roebling

CHAPTER VIII

REMINISCENCES OF BOYHOOD DAYS IN SAXONBURG

IF COLONEL ROEBLING could have been persuaded to write his autobiography it would have resulted in a production of rare merit, for not only was his memory for persons and events of unusual clearness and accuracy, but whatever he wrote bore the impress of his strongly marked personality. In his case the style was the man. He wrote as he talked. He had a gift for racy description and his comments were always pertinent and characterized by a certain caustic, not to say sardonic, humor, and a native shrewdness of observation that were most illuminating. Moreover, his perfect candor, his tendency to use direct language, always to call a spade a spade, and not an agricultural implement, and never to permit his sympathies or his antipathies to distort his judgment or to claim for his achievements or for those of his family any credit which did not properly belong to them, proves that he could have written of himself with the same detachment from personal issues as he was wont to do in the case of others.

Though his integrity never led him to lean over backwards, or to indulge in any semblance of false modesty depreciatory of his own achievements, he yet had no hesitation in admitting his own errors of judgment and in fitly characterizing them. Never hesitating to say precisely what he thought, whether of his friends or others, even to the verge of indiscretion, the Colonel had no spark of malice in him. Dealing always in freedom of speech, he never resented a like freedom in others. All these traits are well illustrated in his extended review of the

THE ROEBLINGS

life and achievements of his brother Charles, which is printed in a subsequent chapter.

If the Colonel could have contemplated himself as the subject of a biography he would doubtless have observed in the spirit of Oliver Cromwell: "If you are going to paint me, paint me wart and all."

Fortunately for the purposes of this biography there have been preserved some reminiscences of his boyhood days in a monograph which he wrote in 1924 and which was subsequently printed under the title of *Early History of Saxonburg* and published by the Butler County Historical Society. The paper was originally read at a meeting of the society held in Saxonburg October 6, 1924, to commemorate the achievements of John A. Roebling, the founder of the settlement. Portions of this memoir have already been freely quoted from in a previous chapter in dealing with the early history of the elder Roebling.

Washington Augustus Roebling, born in Saxonburg, Butler County, Pennsylvania, was the eldest son of John August Roebling and Johanna Herting Roebling.

"My father," wrote the Colonel, "married in 1836 the eldest daughter of Ernst Herting, who had arrived from Muhlhausen with his family two years before. I was born the following year (May 26, 1837) and baptized by the postmaster, Mr. Shilly, there being no preacher as yet—have perceived no ill effects therefrom."

A short sketch of his grandfather, Ernst Herting, is given in the Colonel's reminiscences:

"Ernst Herting came over in 1833, giving up a good tailoring business in Muhlhausen to improve his fortune in the new world. Had a hard struggle the first few years. Built himself a substantial blockhouse on the corner of Main Street and

BOYHOOD DAYS IN SAXONBURG

Pittsburgh Road—standing yet. He was my grandfather, my father having married the eldest daughter, Johanna, in 1836. There were two more sisters. He also raised hops which were in demand. As might be expected, much of my early life was spent under the shelter of my grandmother's roof. When work was slack grandfather would go to Pittsburgh; he even went to Louisville for a year. Raised canaries as a side issue. In emergencies he took a hand at rope-making. The grandmother's maiden name was Catherine Miller, hailing from Verden on the Aller. I spent half my early days at that interesting house. There was so much that was quaint and homelike. Herting went along to Trenton. After three years he returned to Saxonburg to live in our old house."

SPARTAN TRAINING

The boy grew up in this primitive community, composed of newly arrived German colonists, who suffered the usual privations and hardships which fall to the lot of pioneers in an isolated place, where their own labor had to supply them with the necessities sufficing for a bare existence. There were few conveniences and no comforts, as we conceive them today. It was Spartan training for the boy and left its deep impress upon his character.

Except Ferdinand, who was also born in Saxonburg in 1842, and was thus only seven years old when in 1849 the family removed to the more comfortable precincts of Trenton, the other sons, Charles and Edmund, were born in that city at a time when comparative prosperity had come to the family and hence they were spared the rough experiences which were the lot of Washington and to a lesser extent of Ferdinand, who presumably was too young to remember much of the deprivations and hardships of the Saxonburg period. But Washington

THE ROEBLINGS

was always keenly alive to them and had a clear recollection of his early life with its experiences, agreeable and otherwise.

From the time of his birth until the removal to Trenton his father was often away for long periods on his engineering projects, though after 1841, when the making of wire rope began, his presence at home was more frequent. The lad when sufficiently grown began to take his full part in the operations of strand-making and wire-twisting, all by hand.

“About eight men,” he writes, “were needed for strand-making, but sixteen or eighteen were required for laying up the rope. These were recruited from the village and adjacent farm—quite a task—in which I took my full share. The men were always glad to see me because it meant good pay and free meals for days. Work was from sunrise to sunset—three meals, with a snack of bread and butter in between, including whiskey. Meals were served in the house. My poor overworked mother did the cooking, all done on an open hearth. The American cooking stove was just making its appearance. We did not get one until 1847.”

JULIUS RIEDEL, WASHINGTON'S FIRST INSTRUCTOR

His education in the rudiments began at an early date. In 1843, when he was six years old, he was placed under the tutelage of a newly arrived immigrant, one Julius Riedel, who, from the Colonel's account, must have been a man of considerable parts. Riedel in 1842 married Leonora, daughter of Ernst Herting, and a younger sister of Colonel Roebling's mother. They had a son, Edmund Riedel, and thus a cousin, who subsequently became superintendent of the main rope shop in the Roebling works at Trenton, dying in that city in 1923. Edmund and the Colonel strongly resembled each other in personal appearance, and the natural inference is that the Colonel

BOYHOOD DAYS IN SAXONBURG

avored the maternal rather than the paternal side of the house. A son of Edmund is now also associated with the company.

A short sketch of Julius Riedel's variegated career, taken from the reminiscences, will not be out of place at this point:

"One day in 1843 a new character appeared on our front steps—a short, stout man, with a rifle and shotgun slung over his back, a carpetbag in one hand and leading a hunting dog, Rolla by name, by the other. A huge pair of spectacles adorned his face. He had walked up from Freeport, was exhausted and done up. My father took him in and practically took care of him the rest of his long life. Julius Riedel was his name. Having no profession or trade, it was hard to place him, so he was made a sort of tutor for me, teaching the three R's in German. Later on he established a small German school and married my mother's sister, raising ultimately a family of six, who all drifted to Trenton in course of time. Riedel was the son of a Lithuanian baron with a large family, near Tilsit. This baron was a cousin of Field Marshal Blucher. At the time when Napoleon escaped from Elba and entered on his fatal Waterloo campaign, Julius was 16. The father asked the Marshal to let Julius ride along with him, to which assent was given; so Julius came to be near Waterloo, within sound of guns if not in the thick of the fight, and also entered Paris with the Allies, where he remained a while before returning home and commencing life over again, which was hard, as he had a splendid German education but no profession. (There lived another Napoleonic veteran near Saxonburg whom I met occasionally, but being a French Alsatian he was looked down upon.) Riedel's early experiences made a great impression on my youthful mind.

"In 1844 there was a vacancy in the church—no preacher. It occurred to my father that Riedel could fill it; so he was

THE ROEBLINGS

installed at once. He was gifted with a good delivery, a wonderful sympathetic voice that moved the hearers to tears. The church was crowded to capacity—young couples yearned for his services; even the death-bed anticipated his consoling funeral orations. His sermons were taken from Heinrich Zschokkes's *Hours of Devotion*, in seven volumes, which were better than he could write. No one, however, knew the catastrophe that was impending. One day a delegation arrived from the Lutheran Synod in Pittsburgh and demanded his removal on the ground that he was no preacher, not the graduate of a theological seminary, had no license to preach; that the marriages that he had performed were illegal and must be performed over again; likewise the baptisms; but the dead could remain in their graves. The congregation was in dismay, finally gave in and bade a silent farewell to poor Riedel. They never had another preacher like him. After some time a place was found for him as teacher in Columbus, Ohio. When he departed with his little family I was dumped into the same wagon and dropped at Pittsburgh to live with a German teacher named Henne.

“The stay in Columbus did not last long. After some small terms of employment with my father, Riedel moved his family into our old house when we all departed for Trenton in 1849. Thirty years later he came to Trenton. He died in Saxonburg in 1891, at the advanced age of ninety-one. He had filled a large horizon in my early youth. At all times he was a strict adherent to German etiquette. No one could enter his room without taking off his hat and making a profound bow. It is the same in Germany at the present day—the old spirit of caste.”

The reminiscences also include a lively description of another friend and neighbor of early Saxonburg days, one Ferdi-

BOYHOOD DAYS IN SAXONBURG

nand Baehr, for whom, perhaps, John A. Roebling's second son was named:

FERDINAND BAEHR

“Our immediate neighbor was Ferdinand Baehr, from Muhlhausen, expert mechanic and wool-carder, and well-to-do, who had sacrificed his home to strive for unknown benefits abroad. He built a larger house than ours and painted it pink. On the way over to this country his only son died of seasickness. The mother never got over the shock. As a makeshift to hide his grief, Baehr took a great interest in me as a boy. I was his daily visitor. He had brought over fine books, beautifully illustrated, many knickknacks interesting to a child. He established some carding-machines adjoining the house, driven by a white horse, bought wool in quantities. (In those days there were no stocks or bonds to invest in.) His wife's brother, Eisenhardt, was his manager. Eisenhardt had been in the battle of Waterloo, a member of a Nassau regiment which held Hugomont against the attacks of the French. The French bullets rattled like hail against the big oaken doors which were never battered down. Day after day this story was related to me while sitting on the wool sacks. When I called for the twentieth rehearsal he lay dead on a sack. Baehr died about 1844, leaving the house to a friend on condition that he would take care of the wife after his death. She lived for twenty-five years after that. His greatest lament was that he should die without having seen a steam-engine.

“Baehr always told my father it was nonsense to make wire rope on a long rope walk when it could be done with a machine in a small room, but he dodged the question of driving power.”

In the following passage are vividly set forth some of the difficulties and hardships experienced by young Roebling in

THE ROEBLINGS

travelling between his Saxonburg home and Pittsburgh, the nearest large town, where for a period he attended a boarding school:

SAXONBURG A REMOTE LOCALITY

“Communication with the outside world was difficult. The road to Freeport, 11 miles, was all right in summer when the canal was open. The direct road to Pittsburgh was atrocious, especially in winter time—26 long miles. In the Deer Creek valley are steep hills. . . . Many a time have I made that trip. One winter my toes were frozen. . . .

“My trips from Saxonburg to Pittsburgh, where I had been sent to school, at too early an age, by way of Freeport and the canal, or in a wagon belonging to the cabinet-maker Bernigau, who kept a store and drove to town at intervals, exchanging country products for city wares, were a great pleasure in summer time. Starting before sunrise, the first stop was at a coffee house, six miles out, price 6 cents for all the cups one could drink. When half way out, near Deer Creek, we took dinner at Mrs. Staly’s, arriving late in the afternoon. The time was passed in making German verses and poetry. The Pittsburgh rendezvous for Saxonburg teamsters was always at Madam Dubail’s, on 8th Street, an Alsatian, who kept an excellent inn with ample yard room for teams and horses. This good woman often reinforced my starving pouch with delicious tidbits.

“The return trip, especially in the winter time, was something dreadful—uphill all the way, snow or mud axle-deep. A short cut by way of Lawrenceville was often frustrated because the ferryman refused to come over for us. Then we had to turn back, adding six miles to the length of the trip. The road through Sharpsburg was a bed of mud, churned up by the

BOYHOOD DAYS IN SAXONBURG

many iron wagons. The hill at Deer Creek was so steep that the load had to be transferred. Finally Saxonburg was reached late at night—all half frozen and hungry. The waiting Christmas tree was the recompense for all this distress.”

The cabinet-maker, Bernigau, to whom he refers in the above passage, was a special friend of the lad.

“Bernigau,” he writes, “made all the coffins, also wonderful furniture and fancy articles for which the Pittsburgh demand was great. Many happy hours did I spend in his shop! He had no small children. His very particular wife always made me take off my shoes before I could enter her house. Bernigau died early. The widow married his assistant not long after.

“Being the ‘Roebing boy,’ I had the entrée to all houses, to wonder over the many heirlooms the people had brought over—curious old clocks, old Bibles and books, quaint pictures, novel utensils of copper, brass or china, long German pipes. My grandmother Herting had a wooden travelling-box with carved top inside of which a picture of the battle of Navarino was glued, showing the burning of the Turkish fleet; that was a treat. A similar picture depicted Marshal Blucher driving the French over the Katzbach.”

SOCIAL LIFE IN EARLY SAXONBURG

A description of the social life of this primitive German community, as young Roebing recalled it nearly eighty years afterwards, furnishes a delectable picture of the habits and pleasures of those early days:

“The vogue was still German. Lager beer had not arrived; ale was not to the German taste; wine was too dear; hence Monongahela rye-whiskey became the staff of life. Entertainments at home, small parties and dances were frequently held. Bernigau played the violin; Wickenhagen the violoncello;

THE ROEBLINGS

Neher the cornet; Roebling the flute and clavier. During the winter a few plays were enacted at Aderhold's hall by amateur actors, of whom Ernst Helmbold was the best. I remember with delight a play called *Twenty Years After*, another one, *Only Six Courses*. At an early day Aderhold, who kept the hotel and baked bread, instituted an annual festival for sharpshooters, lasting three days, attended by great crowds. I believe they are still continued, although Aderhold has been dead these fifty years. He died while pushing some dough into his oven. My uncle, Riedel, made a poem on the sad event, which is preserved.

"The people were strict Lutherans, but not strict Sabbatarians, so that Sunday afternoon was devoted to reasonable enjoyment. Young men as they grew up generally went to Pittsburgh for a job, but never forgot their native heath.

"I have been back twice, for a day or two, once in 1858 and later in 1868. Such subsequent visits only interfere with the glamour of earlier impressions.

"The early emigrants were usually well educated, knew Latin, belles lettres, history and smatterings of law, and their wives knew how to cook and practise economy.

"Saxonburg," the Colonel observes, "was on the direct route of the annual flight of passenger pigeons from South Carolina to Canada. Thousands rested in our forests, many shot and none left now, the result of unrestricted slaughter."

Although only six years old at the time, the Colonel remembered the great comet of 1843. "I saw the great comet with its head at the foot of Main Street and tail above the church."

Saxonburg, he notes, was subject to strokes of lightning. "Owing to its elevation (1,500 feet), Saxonburg was subject to strokes of lightning. In 1844 our neighbor Baehr's barn was struck on a Sunday afternoon. The roof of our house, close by,

BOYHOOD DAYS IN SAXONBURG

began to smoke, but was saved by wet blankets; the barn was burnt to the ground.”

“Strangers,” the Colonel writes, “who visited the place as a matter of curiosity were disappointed; they found it a quiet little country village. The glamour of former days had vanished.

“As I am writing these reminiscences enough incidents crowd in from the caverns of memory to fill as many more pages, but I refrain. The only religion was Lutheran—only one poor Irishman—Mularky.

“The people who arrived in style were the Helmbolds—had driven in a coach-and-four all the way from the East. Their farm, just east of ours, was the largest and best. The coach was not used very long.

“My youthful associations with the people were so intimate that I could relate more personal occurrences happening in this small community—all thrown together by chance, as it were, and working day and night to better their condition. It is so in all new settlements. As a rule the Saxonburgers had large families—a great help to our early settlers. It was an orderly town—no murders or arrests. About a third of the people came from a district thirty miles south of Muhlhausen called the ‘Vogtei.’ ”

The reminiscences conclude with a list of some sixty of the colonists who were inhabitants of Saxonburg about the year 1840. In addition to drawing upon his own knowledge the writer has been at pains to collect such significant facts concerning them as were available.

Of one Dr. Koch, from Marburg in Hessen, he preserves a lively, though unpleasant, recollection. The above named “was Saxonburg’s only homeopathic doctor. Pulled my best *sound*

THE ROEBLINGS

back tooth. I miss it yet. Homeopathy and my father's hydropathy were the vogue in Saxonburg."

Of another character, Lamb, he writes: "He was a jovial, genial citizen who came to the homes at Christmas time to butcher the pigs, stuff the sausages and have a little party afterwards. He was also a 'First Aid' man and vaccinated me. A staff to lean on in misfortune."

Of the Knoch family, blacksmiths, he records that "they were often employed by John A. Roebling. The son married my cousin, Amelia Roebling, daughter of Karl, late brother of John A. Roebling. She is still living (1924), born in 1837. Her four sons are living in various parts of the United States. The daughter wrote to me recently. This was one of the houses with an enchanting list of old things to please a boy."

Of the Tolly family he observed that "the last boy and girl rejoiced in the names of Theokar and Sheradina."

"My intimate knowledge of these people is due partly to the circumstance that once every ten days or two weeks we made the large rope strands, requiring a dozen more hands, for a day or two, which had to be recruited from the surrounding population. Being a good runner, this task was delegated to me.

"The Saxonburgers were good cooks—could preserve food over winter by drying, or under ground—no canning. No fresh fish; no cranberries or sweet potatoes."

CHAPTER IX

THE MAN AND HIS TRAINING

*Trenton Academy—Rensselaer Polytechnic Institute—
Begins Work in Mill, 1857*

WHEN the Roebling family removed to Trenton in the autumn of 1849, Washington was approaching his thirteenth year. His youthful experiences had taught him self-reliance and habits of industry, the ability to endure hardship and even to thrive under it. His upbringing had been a Spartan one, attended by a drastic home training which included vigorous hydropathic treatment for all physical ailments, real or imaginary, and the prompt administration of the cowhide for the least infraction of the Draconian Code laid down by his father for the government of his household. Young Washington therefore had learned the value of patience in adversity and resignation to the inevitable penalties exacted for infractions of the laws of nature and of man.

But neither the buffets of circumstances nor those of parental infliction had availed to break his spirit or spoil his disposition, which always remained generous and kindly. If at times and under irritating conditions he was often brusque in manner and prone to indulge in sardonic remarks concerning persons he did not like, the essential gentleness of his nature was apparent to all who knew him. His sympathy for the unfortunate, his tolerance for human frailties and his consideration for his servants and employees were marked characteristics of his personality and were probably reactions from his own youthful experiences in the rough school of life at a time when

THE ROEBLINGS

he himself had felt the need of an understanding sympathy, largely denied him.

HARSH PARENTAL DISCIPLINE

His mother, of whom he always spoke with the utmost affection, was evidently a woman devoted in every way to her children, and it was doubtless from her that he inherited the milder qualities which were so conspicuous, at least in the later years of his life, when notwithstanding his constant physical disabilities he was able, under a more cheerful environment, to cultivate a measure of that serenity which the conditions of his earlier and middle life had rendered difficult, if not impossible.

Undoubtedly the severe castigations and almost unremitting scolding and faultfinding to which he and his brothers were subjected when they were growing up left their deep impress upon his mind and character. If the child was not spoiled it was certainly due to no sparing of the rod. The Colonel had the highest regard for his father's genius and ability and, in the case of those who were interested, was always ready to recount his professional achievements. In his reminiscient moods he would, however, speak with small reserve and even with a certain apparent gusto of "the old unhappy far-off things" which belonged to the memories of his boyhood, and, more particularly, of the punishments which he was compelled to endure at the hands of an often irascible parent. He would recall these castigations, often unmerited, with a philosophic calm mingled with a strong sense of their comic aspect.

In an address made upon the occasion of the unveiling of a monument in Trenton to the memory of John A. Roebling the orator of the day touched briefly upon this phase of the father's character, obviously having been previously coached

THE MAN AND HIS TRAINING

in this as in other particulars by the Colonel himself. His words are:

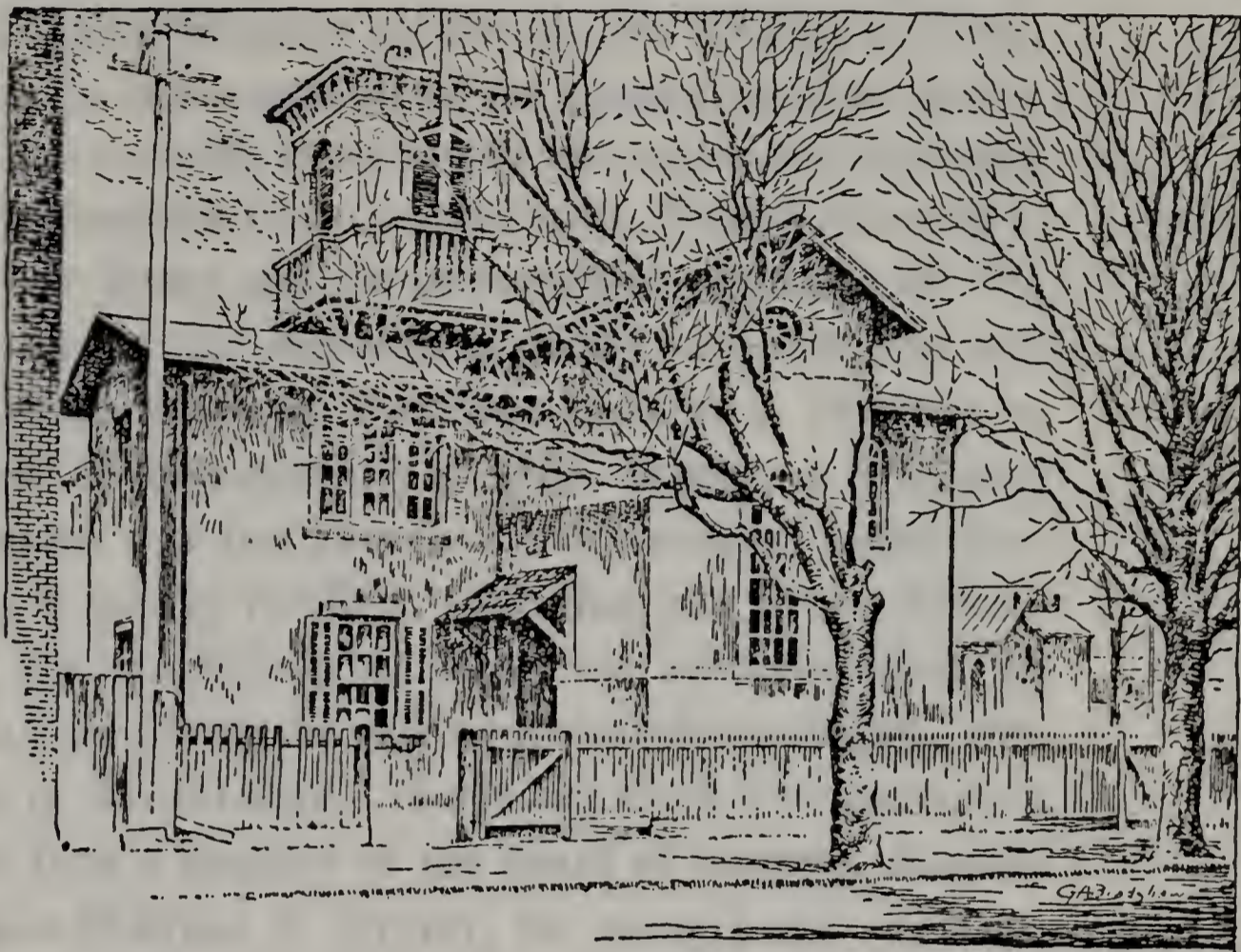
“Parental discipline is all right, coercion is all right, even castigation is all right, if administered *con amore*, so to speak. But John A. Roebling sometimes punished in anger, which is not punishment, but truculence. Is there a mother’s son of us who has not often recalled with a grimace, half whimsical and wholly forgiving, the pendant whip, kept for terror rather than use and more respected by ‘the harmless necessary cat’ than by his graceless boyhood? Has he not in after years rallied his blessed mother on the set speech which always prefaced her occasional application of the whip, to the effect that it hurt her more than it did him, which statement, however doubted then, he knows now to have been the fact? I fancy there are few such hallowed memories clustering about the twig of birch that decorated the home and eke the prancing legs of the Roebling youngsters. That birchen rod meant business.”

During the years in Saxonburg the boy had naturally acquired a proficiency in the German tongue which up to the end of his life he spoke with the same fluency as English. Indeed, it was his habit always to make his calculations in German rather than English. He also understood French and could converse in it, though less readily than in the other languages. The rudiments of Latin he would have acquired under his early teachers in Saxonburg and Pittsburgh and he doubtless pursued the study at the Trenton Academy which he attended after coming to Trenton.

The Trenton Academy was one of the famous schools of the State. It had been started before the close of the war of the Revolution, and among its graduates were many young men who afterwards distinguished themselves locally and in a wider sphere. The Academy finally closed its doors in 1884,

THE ROEBLINGS

after a full century of existence, and then only because it had largely been superseded by the State Model School and the growing excellence of the public school system of the city. During the 1850's, the period when the school included Washing-



The Old Trenton Academy where Washington A. Roebling and His Brothers Attended School

ton Roebling as a pupil, the Academy enjoyed its most flourishing era and the reputation of the teachers was high, particularly that of the principal, David Cole, who was well known throughout New Jersey as an educator and an able writer on educational subjects.

The annual circular and catalogue of the Academy for the years 1851-1852 prints the name of Washington Roebling as a student in the "Classical Department," the highest of three departments, the other two being designated as the "High

THE MAN AND HIS TRAINING

English” and the “Common English.” The name of Ferdinand Roebing, Washington’s younger brother, appears for the same years in the “Common English.” There are twenty-four names in the Classical Department, including William L. Dayton, Jr., subsequently a judge of the Court of Appeals of New Jersey and United States Minister to the Hague. Dayton’s father, also, William L., was a member of the board of trustees at this period. He was a widely known man, having been an associate justice of the Supreme Court of the State, United States Senator from New Jersey and the unsuccessful candidate for the vice-presidency on the Republican ticket in 1856. He was subsequently appointed by President Lincoln as Minister to France, where he died suddenly in 1864. Another of Washington’s classmates was Ion Hanford Perdicaris, of Greek parentage, who, it will be recalled, was kidnapped by the Moroccan bandit Raisuli during the Roosevelt administration, an event which called forth the stirring Rooseveltian slogan, “Perdicaris alive or Raisuli dead.” His father, G. A. Perdicaris, was also at that time a member of the board of trustees. Another classmate was William S. Stryker, for many years adjutant-general of the State and favorably known for his historical writings, the chief of which is his admirable book, *The Battles of Trenton and Princeton*, published by Houghton, Mifflin & Co. in 1898. Another, afterwards eminent man, attending the Academy at this time, though not in Washington’s class, was Dr. Charles C. Abbott, the naturalist.

The Academy catalogue of the same date advises that “Instruction in the Classical Department is given wholly by the principal in person,” and further observes, “it is earnestly desired that no boys will be proposed for admission to its privileges unless their parents or guardians are resolutely deter-

THE ROEBLINGS

mined to exact a faithful discharge of those duties which are assigned for the hours out of school."

It is improbable that Washington had any disposition to shirk his studies, but if he had, his father could doubtless be depended upon to keep him up to the mark.

Another item under "General Remarks" gives this significant warning: "If there is necessity for corporal punishment it is promptly and judiciously administered." The word "judiciously" must have caused a grim smile to appear on Washington's face if he ever read the passage, for "corporal punishment, *judiciously* administered," was something that, in his opinion, he had seldom experienced.

ENTERS RENSSELAER POLYTECHNIC INSTITUTE, 1854

It was his father's wish that his eldest son should follow in his footsteps as an engineer, doubtless perceiving in him the qualities which he was subsequently to display in so remarkable a fashion. Washington as a boy had already demonstrated his aptitude in the mechanical line and even at that early age had proved useful as an assistant to his father.

Between the years 1851 and 1855 John A. Roebling was engaged in designing and building the Niagara Falls Suspension Bridge, the first of his major achievements, and he was away from his home much of the time. During his absences his trusted superintendent, Charles Swan, looked after affairs at the mill and doubtless he was assisted by young Roebling during the time he could spare from his attendance at the Academy. Four years of study in that institution found him prepared at the age of seventeen to enter the Rensselaer Polytechnic Institute at Troy, New York, then probably regarded as the foremost place in this country for the study of engineering, particularly in the mechanical field. There is no definite record covering

THE MAN AND HIS TRAINING

young Roebling's career during his three years' attendance, 1854-1857, but his subsequent eminence in his profession would indicate that he was a capable and industrious student. Two or three of his letters written during his first year and addressed to Charles Swan, the superintendent of the mill in Trenton, have survived.

In one of these letters from Troy, dated March 13, 1854, he asks Mr. Swan to forward to him "a collection of logarithmic tables by Baron de La Vega, published in Vienna and written on the left hand in Latin and the other in French." He tells Mr. Swan exactly where to look for the book and directs him to send it to his address at No. 97 Ferry Street.

In another letter, under date of May 3, 1854, the writer says he is writing "just after having swum across the Hudson" and is therefore tired out. He continues:

"There is no want to me of having plenty to do. It comes of itself, if you only want it, and sometimes there is a little too much of it. As my circle of acquaintances increases, paying even an occasional visit to them takes time. But I will take care of that."

He expresses concern over the "rolling" troubles Swan was having, and evidently at his request sought to find a skilled hand to go to Trenton to work at the task, but could find none. He states that he had heard from "Ferdie" that the Trenton dam had broken away again and observes "had they taken my advice that would never have happened."

He has left on record his conviction that seventeen, at which age he entered, was at least a year too soon for what he calls "that terrible treadmill of forcing an avalanche of figures and facts into young brains not qualified to assimilate them as yet." He states that the director while he was at "Troy" was the hardest taskmaster that ever lived, that "the boys were ground

THE ROEBLINGS

down and crammed with knowledge and mathematics that their poor young brains could not make use of." He added that "the few who graduated left the school as mental wrecks." "I am still busy," he says, "trying to forget the heterogeneous mass of unusable knowledge that I could only memorize, not really digest. When a class [his own] starts with 65 and only graduates 12 it is proof of the terrible grind."

THE ROEBLING BENEFACTIONS TO THE INSTITUTE

But if the memories of his collegiate career were not all agreeable he certainly in after years proved that he was no unfilial son of his alma mater, for his benefactions, together with those of his son, John A. Roebling, 2nd, and his brother, Charles G. Roebling, also graduates, aggregate over \$200,000, and there is a fine dormitory on the campus, built with the Roebling money, and a broadcasting station, WHAZ, also provided by the family. Moreover, Colonel Roebling left a bequest to the Institute in his will of \$50,000.

At the time of Colonel Roebling's death in 1926 he was said to have been the third in seniority among the graduates, A. H. Emory of Stamford being the oldest and Charles Mac Donald the second oldest. The latter spent some years after his retirement in Trenton and the Colonel and he enjoyed many opportunities of recalling old student days.

Perhaps, after all, the Colonel a little exaggerated in his memories the strenuous conditions of his student life, and his delight in forceful verbal utterance carried him beyond the boundaries of sober fact. In any event he never appeared to suffer very much in later life from the evils which he depicts, for obviously he never became one of the "mental wrecks" which he accused the Institute of producing in the educational grindmill as it worked in his day.

THE MAN AND HIS TRAINING

TAKES UP WORK IN THE MILL, 1857

Following his graduation in the summer of 1857, the young engineer returned to his home in Trenton and took up his work in the mill. For a part of this time his father and Swan seem to have been away and Washington apparently was in charge of the mill. He writes letters to Swan giving full particulars as to the condition of business affairs, and particularly as to the matter of credits which seem to have given him much concern. Collections were slow and there were failures of several large houses in Philadelphia and elsewhere. It will be recalled that 1857 was the great panic year and there were widespread failures of banks and commercial houses.

Accompanied by his father, Washington paid a business visit to Washington, D.C., in the spring of 1858 and in connection with these matters writes Swan that he had visited the Capitol and had seen both houses of Congress in session and mentions that his father went to see the Secretary of the Navy in the hope of securing a contract for wire rigging for government ships, declaring that the prospect for obtaining it "was not very bright."

CHAPTER X

BEGINNING A PROFESSIONAL CAREER

IN THE spring of 1858 Washington joined his father who was then at Pittsburgh engaged in erecting a bridge over the Allegheny River. He remained there until the work was completed in the summer of 1860.

During this period he writes many letters to Swan, explaining the progress made on the bridge and ordering certain supplies which were needed for the work on it. The letters also include many side observations upon the current events which interested him. The correspondence begins in May 1858 and concludes the middle of June 1860, when the bridge was completed, after which he went to Kentucky for a period and then returned to his home in Trenton in the late autumn.

Excerpts from these letters follow in chronological order:

LETTERS OF 1858

On May 2, 1858, he announces his arrival in Pittsburgh and gives his impressions of the place which he had not visited since Saxonburg days:

“I can't say that I have seen anything but smoke here as yet; and it strikes me there is a great deal more than there used to be. They have put up so many new rolling mills, and factories and houses, that after all it is not to be wondered at if there is a little more smoke. Pittsburgh has increased wonderfully since I was here, but in nothing more than churches, of which there are any quantity and fine ones, too. I attended this morning at Mr. Preston's church, where I used to go to Sunday School.

BEGINNING A PROFESSIONAL CAREER

We sat in Mr. Holmes' pew. I have a very pleasant boarding house in Penn Street; we have no female boarders fortunately and at the table, which is very well filled, each one digs in and helps himself.

"On the bridge, the masonry of the Pittsburgh abutment is now above the chain, and unless the river should be very high they will be able to stop pumping in a short time. Nothing has been commenced as yet. My time is half spent in the office and half on the work and I always manage to find enough to do so far. Business is quite brisk in town, all the rolling mills are going and any quantity of steamboats coming and going. The town is full of raftmen now, who have brought down their rafts. Once in a while a raft strikes our pumping boat and knocks the connections all to smash, causing a delay in pumping several hours."

He has this to say about the reign of lawlessness in Pittsburgh:

"Pittsburgh is getting to be a great place for murders, stabblings, etc. Something of the kind occurs every day. The concert last night for the benefit of the murdered Baer's family was a brilliant affair, considering that the performers were all amateurs and Germans. I had no idea that so much native talent existed here. But the poorest stick among the performers was a long-legged violin player by the name of Riedel. Just ask Uncle Julius [Riedel, who married his mother's sister] if he is any relative of his."

Evidently a cask of hams, unannounced, had been received at the Trenton home and Swan had written to inquire if they had been sent by Mr. Roebbling. Here is the reply:

"Father knows nothing whatsoever about the hams; he has not sent any; perhaps it is a present from somebody, or maybe

THE ROEBLINGS

there is an infernal machine in the cask. If I were you I would keep it for a while, at any rate, and see what turns up, because if you send it back the railroad company will eat it up."

Here is a reference to the conditions of the iron industry at that time:

"Father admits and, indeed, is almost certain that the whole iron business throughout the country will be very low for the next 4 or 5 yrs., and then look out for the breakers here in Pittsburgh. You see it will be two years before Buck's term expires, then we will certainly have a new tariff, and it will take two years more before its effects are felt throughout the country."

John A. Roebling's intense dislike of the Democratic party crops out in the following passage:

"Father is getting his dander up against the Democrats and says he will turn everyone out of the mill when he gets home."

The elder Roebling's reaction to a proposal for the manufacture of steel wire for pianos is thus described:

"A New York gentleman stopping at the Monongahela who was formerly in the piano-making business and used the improved piano steel wire of Webster and Harper, and also that of a firm in Vienna, says that the latter is far superior to the former. Father from his conversation with the above mentioned gentleman, Mr. Geib, has come to the conclusion all at once that the whole thing is a big humbug; I think however he will change his mind again very soon."

The writer mentions that "The State Fair is about to be held in Pittsburgh when the town will be filled with strangers," and adds this reflection upon the Trenton Fair: "It will be a very different affair from your small potato."

This in reference to his brother Ferdinand's zeal in soliciting

BEGINNING A PROFESSIONAL CAREER

orders (Ferdinand then being sixteen years old and attending a college in Washington):

“I am glad to see that ‘Ferdie’ is stirring around for orders, it is a mighty big beginning—\$24.”

The musical delights of Pittsburgh are thus set forth:

“We are enjoying the English opera here of late; the troupe was excellent, especially the ladies who were very handsome indeed, and splendid actresses. I saw the *Crown Diamonds*, *Barber of Seville*, *Bohemian Girl*, and *Don Pasquale*. The *Barber* was the most comic thing I ever saw. They also played your favorite *Fra Diavolo*, but I did not see it.”

He speaks of a trip contemplated by his father with a view to a possible investment in coal oil lands:

“Father intends going to Cincinnati in about two weeks to take a trip up the Kanahwa to some coal oil works. It is always very well to examine everything in person before investing. The country down there is awful. Every man is a rascal and every second man a thief, and it is about as difficult to get oil to the river as it was to get a Morris Canal rope from Saxonburg to Freeport.”

Speaking of the progress on the piers, under date November 13, 1858, he writes:

“By next Friday I think the last stone will be laid for this season, at least I hope so, because nothing can be told beforehand with any degree of certainty here.”

In the same letter he records a visit to Pittsburgh of a Trenton friend, a manufacturer of anvils in that city:

“Clark Fisher passed through the other day; I prevailed upon him to stop off a day and take a look at Pittsburgh. He was thoroughly disgusted with it, I can assure you. You see it happened to be one of those dark, cloudy, smoky afternoons, when the sun doesn’t shine and the gas is lit at 4½; he can’t

THE ROEBLINGS

imagine how anybody can live here and enjoy life. For my part I feel quite sorry that I will have to leave it."

Speaking of the hydropathic cure which the Pittsburghers of that day were wont to take at Philipsburg, he writes:

"Quite a number of Pittsburghers have been down at Philipsburg this summer and got touched up a little in their health. But the trouble with some people who have undergone the water treatment is that they can do just as they please afterwards and eat what they like, and the result is that in a year or two they are as bad off as ever."

He mentions the case of a friend who was much benefited by the cure:

"He has improved wonderfully and looks and feels like a new man. When he went there he was a dyspeptic, had a sore throat with an abscess in it, etc., etc. All those evils left him under about a month's treatment and starving. This latter part of the cure he disliked more than anything else, because bathing always gave him a tremendous appetite."

He records the approach of the one hundredth anniversary of the capture of Fort Duquesne, on November 25, 1858:

"Our celebration of the 25th promises to be a grand affair. It is in honor of the taking of Fort Duquesne one hundred years ago. Everett will deliver a speech on Washington in the freight depot of the Pennsylvania R.R., which you know is built on the site of the old fort. Old Judge Wilkins is the presiding officer. Salvos of artillery will be fired all day long from the Point and a procession 10 miles long is to march through the town. That was the reason why the Governor appointed the 18th in place of the 25th for Thanksgiving."

He finds many friends in Pittsburgh:

"I am perfectly at home in this place and have ten times as many acquaintances as in Trenton."

BEGINNING A PROFESSIONAL CAREER

With this letter the correspondence for 1858 comes to an end, to be resumed again in the early spring of 1859.

LETTERS OF 1859

Chess, it would appear, was a favorite game in Pittsburgh at this period:

“Everybody has learned to play chess during the last winter. Paulsen’s visit evidently stirred them up; some of the Pittsburghers are said to have beaten him very badly when he was here, which is more than many cities can boast of.”

In April he writes:

“I am glad to hear that you got that steamer to rig. You will have a nice job there which will keep you busy and jumping around. In one week I bet you will see me jumping about here; you had better come out and see how it is done.”

In June he writes:

“Your last letter contained quite cheering accounts about the business at home; previous to that we thought at one time that you would dry up altogether in the way of making wire rope. People had probably got the spring fever and were too lazy to order.”

He reports progress on the bridge:

“By the middle of this week the cast-iron towers will be up in place. Two columns and the bed-plate are up already; we put up two columns a day; they are awkward things to handle because they can’t stand up alone; it was more troublesome to hoist the shears on the pin; they are 50 feet long and had to be hoisted up in a vertical position with only two guys instead of four. About the 4th of July the masonry will all be finished—Thank the Lord.”

He remarks that Pittsburgh is improving in an architectural way:

THE ROEBLINGS

“Pittsburgh is getting along quite smart now; I doubt if there is a lazy man in it, your humble servant perhaps excepted. The spring season has been very fair for iron and glass business, especially nails. There is a perfect mania here for improvements. Every day somebody commences to tear down an old house and put up a new one with an iron front. The people will get over that in about two years and then will be the time for you to come and see the town. You would scarcely know it again, especially 5th Street. One interest however is at a standstill, namely steamboating. A month or two ago you recollect 10 boats were burnt up, occupying the whole wharf from Wood to Smith Streets—well, the wrecks are lying there yet and they seem to be in no hurry to get them away. You see from that how little demand for wharf room there is among boats. The lower wharf is now altogether taken up by large coal tugs which take coal boats to New Orleans and bring them back empty. The quantity of coal mined here is increasing every year and the large capitalists are gradually buying out the smaller ones, thus making it a surer business. Hayes, a few miles above here, has over five miles of river front, and every year he puts up a new slope and rents it out to somebody, charging him \$1,000 for the coal he takes out.”

He writes in July, referring to a visit made to Pittsburgh by his brother Ferdinand:

“ ‘Ferdie’ no doubt has told you of all the wonderful events that have happened during his stay. He was very anxious to get back and go to shooting woodcock; he did not even have enterprise enough to go to Saxonburg. If I had not been so busy I would have gone along with him.”

This about the dislike of the treasurer of the bridge company to paying bills:

BEGINNING A PROFESSIONAL CAREER

“Our treasurer makes a face ten yards long whenever Father hands in a little bill of \$6,000 or \$7,000.”

In September he has a little fun with Swan, chaffing him about a doctor's bill which he was supposed to owe to a Pittsburgh physician:

“I admit that you still have some friends left here who will not forget you as long as they live. Among others there came the other day a man, asking if there was not a carpenter working for Mr. Roebling by the name of Charles *Snow*. I told him no, there is no one here by that name. Thereupon he handed me a little bill for professional services? ? ? by Doctor W—— of St. Clair Street to the tune of \$45 upon which \$10 had been paid; the bill was dated February 16, 1848. I told him that a man by that name had worked for Father at the aqueduct and then went to Jersey and had not been heard of since. That put a stopper upon Doctor W——'s hopes and with a long-drawn sigh he returned to his office close by the bridge. Now I want you to confess right out what kind of professional services those were—because the Doc's reputation is none of the best.”

On October 18 he writes:

“Yesterday the last strand of the big cable was finished; tomorrow we commence wrapping.”

It seems that the people in Allegheny were vexed over the bridge-tolls charged:

“The Allegheny people are down on this bridge and three or four articles have appeared in the papers, pro and con. They can't get used to paying trip tolls since they have been accustomed all along to pay by the year.”

He had met with an accident and thus describes it:

“I was delayed in putting this letter into the office by having had a hole knocked into my head accidentally but I am happy

THE ROEBLINGS

to inform you that it is healed up again. I am all right, however. I experienced for the first time the delightful sensation of being knocked insensible."

On November 10 he reports:

"We have got along well on the bridge; the big cables are wrapped, all but about 50 feet at each end when we ran out of wire and have had to take the smaller size—you will have to make some more perhaps—2,000 feet. The suspenders are all hung up in the main spans and in a day or two we hang on beams; wrapping goes very well, no trouble after once getting started fairly. In fact we have been getting along faster of late than we expected."

As to Christian morality in Pittsburgh:

"I send you two papers containing an account of Rev. Mr. R.'s trial. You will see that although Pittsburgh claims to be the most orthodox Christian city in the United States there are still some very rotten persons in it."

About the sun spot:

"Have you noticed the black spot in the sun lately? We can see it here without smoked glass. Mr. B. attributes the cold spell of last month to that alone." A postscript: "Tell that lazy chap Ferd to write."

LETTERS OF 1860

There were five letters written in 1860:

"This is my first letter to you in 1860 and consequently I shall make it very short, because it is always a good rule to make a small beginning, but a big ending, and, since I don't expect to be here towards the end of the year, you may always expect small letters. Cousin Henry [Henry Charles Polycarpus, the son of his Uncle Karl] from Cincinnati was here yesterday; he is a very fine young man now, a perfect beauty; he was

BEGINNING A PROFESSIONAL CAREER

raising a goatee, containing $11\frac{1}{2}$ hairs, just about as many as I would have if I were to attempt it. He is going to Europe next summer for the benefit of his health unless he should be appointed to the treasurership of one of the Cincinnati banks."

Under date February 24, 1860, he writes about a terrific storm that had taken place the day before:

"Yesterday we had a furious storm; it must have been as violent as the one you had lately. All hands had to quit, they could not stand up and I expected to see our foot-bridge go to the dickens, every moment; she jumped and pitched and reared like a wild horse, the new bridge shook a great deal sideways also because no planks are on yet to make her stiff in that direction. Yesterday morning we had 65 degrees heat and in the night it snowed; that explains the storm."

As to the time of the opening of the bridge he writes:

"I am afraid that the contemplated opening of the bridge by April 1, won't be exactly accomplished; it will probably be the 15th. All the stays have to be cut off yet and put on before we can open and you know that those are not a few by the bill of rope you sent us.

"The wrath of the Alleghenians has at last reached its full height and they have determined to build a free bridge right next to ours; that is to say, a petition has been circulated for a charter, and since that don't cost anything, it was fully signed and was nine feet long according to last accounts. The whole move is only intended to frighten our people to put the toll down to nothing."

A great freshet on the Monongahela is thus described under date April 16, 1860:

"Last Monday we had a rousing freshet, 29 feet of water in the channel. The water commenced running into all the streets; all the Point rats were drowned out as usual; the same

THE ROEBLINGS

over in the lower part of Allegheny. Beyond the filling of cellars and damaging of floors there was not much damage done, except in the Monongahela, where 17 coal boats were sunk. The Monongahela bridge will have about \$4,000 damages to pay for coal boats sunk against its piers. The company has to pay those damages every year and the effect will be to break it up sooner or later. During the last 3 weeks we have had incessant rains. The main bridge was to have been opened for foot-passengers today, but for the rain. Tomorrow we start to take down the small bridge which will take a week; the main floor will not be opened before the first week in May. We have quite a pile of men at work now; the check roll runs up to \$600 per week. In the next *Frank Leslie's* you will see a picture of the bridge as she appeared during the flood. I am getting along quite well putting up the stays; it takes some force to handle about those heavy ropes. A Russian government engineer has been here for a few days; Father says he knows more than any other engineer he has ever met; he is travelling in this country to see the public works and will call at Trenton next summer. This is the day of the prize fight, I believe. Hurrah! for the one that beats."

Ferdie's remissness; consumption of lager beer:

"I wrote to 'Ferd' some time ago, wishing him to send me a few circulars, but he seems to have forgotten all about it. Please nudge his memory. Also please send me a little sample in your letter of No. 27 about 4 feet long; it's for a Dutchman who hoists a keg of lager beer out of his cellar; he comes about once a week to get a new piece of sash cord, and I am afraid he will use up all we have because the consumption of lager is increasing fast."

The Western delegation to the Baltimore Convention a tough gang:

BEGINNING A PROFESSIONAL CAREER

“On Friday, June 17, we went to New Brighton to look at *our* car factory. They have eight cars under way, seven of them small passenger R. R. cars, all iron; two of these came up yesterday and are now running in town; they are a perfect success, and moreover being the two first ones they cost about \$300 more than they can be sold at. On our return we had the misfortune to get into a train containing the Western Democratic delegations to the Baltimore Convention; they were an awful hard set in the way of looks and were of course all Douglass men. I expect you are waiting to see me home some of these days. I don't think Father will get away before the 4th, if then. The brick work of the toll-houses is done and the two steeples up. The toll-house steeples are in the style of that on the top of our house only 3 times as high. We have the railing and cornice on the upper side; it looks very fine. It is very hot now-a-days and the water is low, which fact reminds me that it is time to dry up.”

CHAPTER XI

CIVIL WAR SERVICES

Enlistment—With Army of the Potomac

FOLLOWING the completion of the Allegheny Bridge at Pittsburgh, the young engineer returned to Trenton in the autumn of 1860 and took up his work in the mill.

On February 21, 1861, Lincoln paid a visit to Trenton, while on the way to Washington for his inauguration, and made a short speech. As the Roeblings were then, and have always since remained, staunch Republicans, to the third and fourth generation, it is to be presumed that father and son were much impressed by the occasion and were in full sympathy with the President's policies and prepared, should the necessity arise, to support him in his efforts to preserve the Union, even if civil war were involved.

THE FATHER ENCOURAGES THE SON TO ENLIST

When the call came on that fateful April day, if Washington needed any encouragement to enlist in the war, which he presumably did not, his father would doubtless have furnished the incentive and provided the occasion, for John A. Roebling was not the man to spare himself, nor even his eldest son, who was his right hand, in a cause in which he felt great principles were involved. How the father encouraged his son may be inferred from the following story:

At a time when the crisis was impending, and the probability of war was being everywhere discussed, one evening as the family sat at the supper table, the father turned to his son

CIVIL WAR SERVICES

Washington and said to him, with that harsh abruptness for which he was noted: "Don't you think you have stretched your legs under my mahogany about long enough?" Washington was eating a hot potato at the moment and was thus prevented from making an immediate reply. When he could recover himself he dropped the half-consumed potato, rose from the table and departed without uttering a single word. As the story goes, he enlisted the next morning and literally never did return home, for as soon as the war was over he married and was henceforth the head of a household himself.

This is the substance of the story as those who have heard the Colonel tell it, recall. Doubtless the incident may have been exaggerated in the repetition, but it is so far in agreement with the characteristics of the parties concerned that it seems entirely plausible.

YOUNG ROEBLING ENLISTS IN 1861

Following the attack on Fort Sumter, President Lincoln's call for volunteers, issued April 15, 1861, met with a ready response from the young men of Trenton. Company A, of the State Militia, had been organized November 30, 1860, and on April 16, 1861, in response to the President's proclamation, reported for active duty.

On the same day, as appears from the official records, Washington A. Roebling, then in the twenty-fourth year of his age, enlisted in Company A as a private. The following official outline of his Civil War services, as taken from the archives in the adjutant-general's department in the State House at Trenton, mentions the various military units to which he belonged and the capacity in which he served:

Washington A. Roebling—Enlisted as a pvt. Co. A, N.G., State of N.J., April 16, 1861, discharged to enlist in New

THE ROEBLINGS

York; enrolled June 15, 1861, as pvt., 6th New York Independent Battery; Sergt., Sept. 11, 1861; 2nd lieut., January 23, 1862; discharged May 26, 1864, to accept commission as major and A.D.C., U.S. Vols.; resigned January 1, 1865; commissioned lieut-col., U.S. Vols., by brevet, to date from December 6, 1864, for gallant conduct during the campaign before Richmond, Va.; Col., U.S. Vols., by brevet, to date from March 13, 1865, for gallant and meritorious services during the war."

In his report for 1861 the quartermaster-general of New Jersey said of Company A:

"The young gentlemen composing this company performed all the duties of a military garrison, and at the same time rendered important service in the work of arming and equipping the troops for the field, for the period of three months service, from the 16th of April to the 16th of July, in which time seven regiments, four of militia, and three of volunteers, were fully armed and equipped."

But mere garrison duty in his home town was evidently not to the liking of young Roebling. He yearned for more active service and a few weeks later managed to obtain his discharge from Company A, when he enlisted again as a private in the 6th New York Artillery.

He was not long in obtaining the promotion to which he was entitled by his abilities and training in the work of an engineer.

In 1862 he was transferred to the staff of General Irvin McDowell and assigned to various engineering duties, notably the construction of a suspension bridge across the Rappahannock River. Later he served on the staff of General John Pope and participated in the campaign which ended in the Second Battle of Bull Run. He was present also at Antietam and South



*Washington A. Roebling in 1861,
as a Private in the Civil War*



*Washington A. Roebling in 1867, from a
Photograph Taken at Muhlhausen*



*Mrs. Washington A. Roebling and Her In-
fant Son, John, at Muhlhausen in 1867*



Colonel Washington A. Roebling on Little Round Top, Gettysburg, beside the Statue of Major General Gouverneur K. Warren. His Brother-in-law and Former Chief

CIVIL WAR SERVICES

Mountain, during which time he built a suspension bridge across the Shenandoah River at Harper's Ferry.

This bridge was captured by the Confederate forces, who entirely destroyed the flooring system. Colonel Roebling reconnoitered this bridge while it was still in the hands of the enemy. He prepared a complete new flooring at a distance, and when the Union Army reoccupied the position he was able to restore the bridge without loss of time.

From August 1863 until March 1864 Colonel Roebling was attached to the 2nd Corps, serving on engineering duty and later on the staff with the 5th Corps during the Overland campaign.

After the battle of Chancellorsville, it became his duty to ascend every morning in a captive balloon to reconnoiter the enemy and watch from the basket the movements of the Confederate Army. On one of these flights he was the first to discover that General Lee was moving toward Pennsylvania, and he reported his observations to General Meade.

Mention is made of these balloon ascensions in Winkler's recent book, *Morgan the Magnificent*, where it is stated that Mr. J. P. Morgan, sitting in his office in New York, was informed by telegraph, among other happenings, of Colonel Roebling's daily sessions in the air.

ON LITTLE ROUND TOP AT GETTYSBURG

Ten days before the Battle of Gettysburg it was discovered that there was at general headquarters no adequate detailed map of Pennsylvania. Colonel Roebling remembered that his father possessed such a map. He was immediately ordered to go to Trenton and bring back the map. During his absence the movements of both armies had been so rapid that upon his return he was unable to locate either of them. Taking the map,

THE ROEBLINGS

he mounted his horse and rode in search of the Union Army. He was in such danger of capture by the Confederate cavalry that he and his horse slept one night in a cave. It was not until daybreak of the morning of the first day's battle that the Colonel was able to supply General Meade with the information desired.

On the second day of the Battle of Gettysburg he was on Little Round Top with General Warren, when the latter discovered the beginning of Hood's furious attack, which threatened to outflank and defeat the whole Union Army. Colonel Roebing, with his own hands, helped to drag up the first cannon, which did so much to save the position. In fact, history regards this achievement of General Warren and his staff and men as the turning point of the war.

In Jesse Bowman Young's book, the *Battle of Gettysburg*, it is said in Chapter XXI, pp. 239-40, "The Safeguarding of Little Round Top":

"Then General Warren and the staff officer [Roebing] with some stragglers near by helped to pull the guns by hand into position, no room being found for the horses just at that point."

Commenting upon the military ability of General Warren, a recent writer in *Captains of the Civil War*, Yale University Press 1921, affirms that "Warren was not only a good commander of engineers, but a good all round general, as he showed by seizing on his own initiative 'Little Round Top,' without which the left flank could never have been held."

On the third day of the battle Colonel Roebing was consulting a map on a table at General Meade's headquarters when a cannon ball carried away two legs of the table without injuring him.

"Colonel Roebing served on the staff of General Warren,

CIVIL WAR SERVICES

who was in command of the 5th Corps, through the bloody campaign around Richmond, from the Battle of the Wilderness, through Spottsylvania, the Crater fight at Petersburg, and nine other battles to that of Hatcher's Run. His last duty as a soldier was assisting in the destruction of the Weldon railroad in December 1864.

In 1877 General Warren, in writing to a friend, said: "Roebing was on my staff and I think performed more able and brave service than any one I knew."

SOME WAR ANECDOTES

Colonel Roebing was close on hand at the time when General Sickels lost his leg. He was present with General Warren's division on the occasion when they saved Sickels' corps from annihilation. In the controversy over the matter, which was carried on for many years, Colonel Roebing never hesitated to express his opinion that "Sickels had no business to be where he was. When General Sickels went to Meade's headquarters he was ordered to go to his own men and it was in getting back that he lost his leg."

Another incident in which Colonel Roebing figured is told. It relates to an unsuccessful effort of a detachment of Northern soldiers to send a cannon ball into a barn under cover of which a number of Southern sharpshooters were sniping the Northerners. Colonel Roebing came along and saw the shots from the old cannon going wild. By raising his hand he learned the course of the wind, aimed the cannon accordingly, and ordered the gunners to try another shot, which they did, and the barn was instantly demolished. The sharpshooters, deprived of their shelter, were all killed and not a man on the Union side lost his life.

At Fredericksburg Colonel Roebing was quartered late at

THE ROEBLINGS

night in a stone jail. In the middle of the room stood a large chest that aroused his curiosity. He unfastened the lid, lifted it up, and put one of his hands inside to feel the contents. What was his horror to find that it came in contact with what appeared to be the cold forehead and nose of a corpse. Needless to say he quickly abandoned his investigation. When the morning came and he could see plainly, he found that the chest contained a stone statue, which he afterwards learned represented Mary Washington, the mother of George Washington. Preparations for the erection of the statue had been made just previous to the outbreak of the war, but the project had been indefinitely postponed, and meanwhile the statue had been stored in the jail for safekeeping.

Another little incident is told of the Colonel's war experience, in which Major Carl Lentz of Newark, one-time Republican leader there, figured. It was on the day when the New Jersey electors met in the State House to cast their vote for the late President McKinley's second term. Colonel Roebling was one of the electors, and Major Lentz was entertaining the party with war stories.

Major Lentz declared that as he with others on picket duty were crossing the Rapidan just before the Battle of the Wilderness, under orders from brigade headquarters, one of the soldiers barely escaped drowning when his horse was carried away by the strong current, as the men forded the stream. The Major told in detail of the happening, and as he finished his story Colonel Roebling declared that the Major had told the incident exactly as it had occurred as he himself was there at the time.

In his book, *Meade's Headquarters*, made up of his war-time letters, Colonel Theodore Lyman, of General Meade's staff, has some scattered references to Colonel Roebling.

CIVIL WAR SERVICES

Under date November 30, 1863, page 56, he records the following incident:

“Captain Roebling from General Warren’s staff galloped up. He is the most immovable of men, but had at that moment rather a troubled air. He handed a scrap of paper. General Meade opened it and his face changed. ‘My God!’ he said, ‘General Warren has half my army at his disposition.’ Roebling shrugged his shoulders. The note was to the effect that General Warren had made a careful examination of the enemy’s works, had altered his opinion of last evening and considered an assault hopeless.”

On page 168 under date June 18, 1864, there is another reference:

“Our lines were advancing and there was an inexplicable silence along the skirmish line. At 6:50 came an order for all the line to advance and attack the enemy, if found. A little after seven Major Roebling came in and reported he had discovered the enemy’s new line of works, that ran along a high ground beyond the railroad, that they were all there with batteries in position. Soon after General Warren mounted and we all rode to the front, over a wide oat-field past the works captured last evening, from which we were afterwards driven.”

On page 240 under date October 6, 1864, there is an amusing description of Colonel Roebling’s appearance and manner:

“Roebling is a character, a major, aide-de-camp and engineer. He is a son of the German engineer Roebling, who built the celebrated suspension bridge over the Niagara River. He is a light-haired, blue-eyed man, with a countenance as if all the world were an empty show. He stoops a good deal, when riding has the stirrups so long that the tips of his toes can just touch them; and, as he wears no boots, the bottoms of his pantaloons are always torn and ragged. He goes poking about

THE ROEBLINGS

in the most dangerous places, looking for the position of the enemy, and always with an air of entire indifference. His conversation is curt and not garnished, with polite turnings.

“ ‘What’s that redoubt doing there?’ cries General Meade. ‘Don’t know; didn’t put it there,’ replies the laconic one.”

In April 1864 Colonel Roebling was promoted to the rank of major, a little later he was breveted lieutenant-colonel.

In January 1865 he resigned from the army, subsequently receiving the full brevet-rank of colonel.

In later days he could often be persuaded to repeat stories of his military experiences for interested auditors and there were many such.

When the Spanish War broke out and the Colonel was now well on in his sixties, he expressed the wish to serve his country once more. He actually made application to the authorities, but, of course, his services were declined on account of his age and physical disabilities. In referring to the matter the Colonel remarked that he was sorry, as he would have liked to fight for his country in every war in which it was engaged during his lifetime.

In 1921, in response to an inquiry made by someone who was seeking information as to people who had seen President Lincoln, Colonel Roebling wrote the following letter:

“In answer to your curious quest as to people who saw Lincoln, I would say that I was in the Civil War for four years and saw Lincoln on two occasions—the first time in May 1861, when he spoke a few words of welcome from the rear portico of the White House to the newly arriving soldiers, one of whom I was, and secondly about April 1, 1864, when he came down to Culpepper County to review the army previous to the Battle of the Wilderness. I was at that time major and aide-de-

CIVIL WAR SERVICES

camp to General Warren, commanding the 5th Corps, and joined in the cavalcade.

“The President was mounted on a hard-mouthed, fractious horse, and was evidently not a skilled horseman.

“Soon after the march began his stove-pipe hat fell off; next his pantaloons, which were not fastened on the bottom, slipped up to the knees, showing his white home-made drawers, secured below with some strings of white tape, which presently unravelled and slipped up also, revealing a long hairy leg.

“While we were inclined to smile, we were at the same time very much chagrined to see our poor President compelled to endure such unmerited and humiliating torture. After repairs were made the review continued, but was shortened on his account. I never saw him again and was in Covington, Kentucky, when I heard of his assassination.”

CHAPTER XII

LIVELY LETTERS FROM THE FIELD, 1861-1864

DURING the Civil War period Colonel Roebling wrote a series of letters from the field to Charles Swan, the superintendent of the Roebling works at Trenton. These letters, fortunately preserved and never before published, cover a period from the autumn of 1861 to the winter of 1864. They give his whereabouts, a general outline of his doings, and his reflections upon the course of events. Reference is made to the military bridges he built at Harper's Ferry and elsewhere.

The letters are fragmentary and discursive in their character and presuppose a general knowledge on the part of his correspondent of the major operations pertaining to campaigns in which the units to which he belonged were engaged. The writer says little about the battles and nothing of his own personal exploits. The letters may be regarded as a sort of footnote to the history of the Campaign in Virginia and as embodying the experiences of an intelligent observer in his immediate environment. Possibly, in connection with the experiences previously recorded by others, these letters may serve to throw some additional light upon the conditions which prevailed in the localities where the writer was stationed.

Some of the letters lack a year-date, but it is not hard to determine from the context in which period they fall.

There has been no attempt at comment or interpretation, since this would be unnecessary in the case of those who are familiar with the military history of those days, and in the case

LETTERS FROM THE FIELD, 1861-1864

of others would require a detailed elucidation for which space is not available.

Camp Cameron,
Co. K., 9th Regt., N.Y.S.M.
Washington, D.C.

(No date, probably the summer of 1861.)

Your turn has come at last for a letter, and as we have plenty of loafing time just now, I thought it well to sit down. It is very pleasant today after the shower of last night, but since we have moved our tents to a more shady place, we can stand it better. Things progress very slowly here. Loafing in the camp seems to be the principal occupation of not only ourselves but everybody else. During the cool of the morning and evening we practise sabre exercise; probably we will know something about it in six months from now. Sergeant Alexander, whom you met in the cars with me, gives the sabre drill. It seems that he is so much of a German as you or I, but he seems ashamed of it and never lets on that he understands a word. He is moreover from Breslau, and a countryman of yours. Some one stole his revolver and cigars; thief is undiscovered so far and consequently he is rather wrathful. He caught a fool of a Secessionist in town the other day. The boys look on him as an old humbug.

We would have had our horses before now and the whole lot was ready for us, when Major Sherman stepped in and picked out all the good ones for his battery, leaving us the bad ones, which our captain very properly refused to take, and therefore we will have to wait till they get another lot of good horses together. Sherman's battery went through some manoeuvres near our camp this morning. The sight is very interesting; the commands partly given by word, and partly

THE ROEBLINGS

by bugle. We got a wagon and 2 horses yesterday from the Maine boys—that is something, at any rate. If they keep on this way the war will last 10 years.

McComas' regiment from New York came in town yesterday. During the night they had furlough, and, of course, got drunk, committing all sorts of mischief. Our guard caught a number of them and kept them prisoners for the night. There are about 200 men in camp, including ourselves; they are mostly recruits for the different companies—our regt. One of them, a German, was badly frightened last night. While on guard his revolver went off in the case, the ball passing through the stock of the musket. He imagined of course that he had been shot by a Secessionist; discharged his musket into the bushes and alarmed the whole camp. When he got over his fright he smelled something like burnt leather, and that let the cat out of the bag.

Several of our boys are musical, every night there is singing and guitar playing, going on till 9½ when we have to be in bed. Morning call is at 4½, drill from 5 to 6 before it gets too warm, and evening drill 6 to 7. We do not march to the arsenal every day, though three times a week the Grand Rounds come at 2 o'clock in the morning. They consist of staff officers, with an escort of the President's Mounted Guard; they visit every camp in the district that night on this side of the Potomac, and that is a circuit of about 30 miles. Their horses are very fine and go like thunder. When they approach the whole guard has to turn out and present arms.

I believe the Jersey crowd is coming soon. If they come in a body they will make a fine impression, because every regiment makes it a point to march along Penna. Avenue from the Capitol to the White House. Most of them look tired, fagged out and dusty. I have seen no drilling as yet to beat our Com-

LETTERS FROM THE FIELD, 1861-1864

pany A, in Trenton. At the same time I can't say I have seen very much. They say our regiment is pretty good but I have not seen them. Please tell "Ferdy"¹ to go to Grammetts' and order a pair of shoes for me, medium high around the ankles and with projecting soles, thus [he gives a sketch of the soles] soles double heavy. He has my measure from my last pair of shoes. Tell him that the last pair was a little tight around the instep and to make them a little wider; put on lacing leather strings and send to me per express (prepaid) care of E. K. Knorr, 514 K. St., Washington.

In the gun practice today the stick was struck.

Give my respect to all.

Poolesville, Md.

September 1, 1861.

This is the first chance I have had for writing for over a week on account of our marching back and forward without much apparent purpose. On Saturday our captain received orders from Gen. McClellan to detach himself from Bank's Army and report himself to Gen. Stone. We accordingly left Clarksville and approached the place where Stone's Brigade is located. Please take notice therefore that I am no longer in Gen. Bank's Army. In addition to being commissary I am now chief gunner and corporal of one of the new rifled cannon, which arrived last week. It is the place which I like best, because the gunner has all the sighting and pointing to do and can have the pleasure of popping over the rebels. The gun fires 13 lb. shell, weights 871 lbs. and is larger than the other pieces which we had.

This little country town is about five minutes from the river where we go every other night on picket [duty] with our pieces. Rickett's U.S. Battery is encamped here with us. You

¹ His brother, Ferdinand.

THE ROEBLINGS

will remember that he was taken prisoner and lost his pieces at Bull Run; besides having 30 men killed. The men say that the loss of their battery was entirely owing to a mistake on the part of their officers in abandoning their first position, which they could have held against any odds.

Captain ——, U.S. Battery with whom we were encamped at Hyattstown, is ordered to report to Anderson in Ky. The river bank on the opposite side fairly swarms with Secession-ers. They have thrown up heavy earth-works mounted with cannon, at every place where there is a chance to ford in low water. At present the water at the fords is at least six feet deep, rendering this impossible. Skirmishes take place daily. Three companies of the Mass. Regt. on picket were compelled to leave by rebel shells, our muskets not reaching across. Three companies of Indiana riflemen were then sent for and in less than 15 minutes they drove away every man from the guns and even made them leave their earth-works. Banks is approaching Washington and will most likely join McClellan. At the present high stage of water General Stone's column will suffice to prevent the rebels from crossing in any considerable force. The country around here is flat and level like Jersey. The Potomac bottom, on the Maryland side, spreads out ten miles in width and the Virginia side is hilly at once. Their earth-work and camps are visible from here with a spyglass.

This letter goes by private conveyance to Washington and I must close immediately.

Camp Stone,
Near Poolesville,
November 13, 1861.

I wrote to you the last night, just before the fight at Ball's Bluff. That is nearly a month ago and it is about time to write you another letter. There is absolutely nothing of any interest

LETTERS FROM THE FIELD, 1861-1864

going on at present; the life we are leading just at present is very tedious. We have no chance to see anybody; we can't even see Virginia from our woods. Rabbits and quail abound, but they are poor shooting without a dog. A member of Rickett's regular battery who are in the woods with us was killed night before last in a drunken spree by the proprietor of the gin mill. The murderer fled that night. The next day about one hundred cavalry were sent in pursuit, scouring the country far and wide. He was caught, hid in some bushes at the foot of Sugar-Loaf Mountain. Stone would have had him shot on the spot, but he preferred to turn him over to the civil authorities who will undoubtedly hang him because he has been a dangerous character heretofore.

One of our teamsters left us today. He is over 60 and can no longer endure a winter's camping out. He was the best driver and had the best team in the whole division. He is worth say, \$15,000, but has been a teamster all his life and determines to stick to it to the end. Previous to 1830 already he drove a Cannestoga wagon from Philadelphia to Pittsburgh and knows everyone along the road. There is not a State in the West or South where he does not know every inch of the ground. He knows all the Shakers on the Kentucky now, having hauled for them and also stopped three months while agent of the great Southern Through Mail. In his younger days he went through the Indian War under General Jackson. We are all sorry to lose him, for although he promises to return in the spring, I expect the rheumatism will have too tight a mortgage on him. Only two things prevented him from becoming a prominent man in the West and these were the want of a little early education and secondly, *whiskey*.

Let me hear something about the big rope machine; by this time you will have no doubt tried it. I received a letter from

THE ROEBLINGS

Rhule² a short time since. He reports the water as having risen above the cables; they must have been hung very low. Rhule says in his innocent way that it does him a great deal of good to hear once in a while from Father and myself. I suppose you have heard the malicious story which Dobie relates about Mr. Rhule and a certain widow in Pittsburgh. Give my respects to all.

Camp Dickinson on the Potomac.
Opposite the Shipping Point Battery.
December 14, 1861.

I wrote a few lines to "Ferdy" in Washington, being too busy to write more. We left there on Sunday afternoon, making only five miles that day, passing by three forts which protect the city from the south on the Maryland side. They are not quite finished and mount but few guns as yet. We encamped just opposite Alexandria; it was too hazy however to see anything of the camps opposite and beyond the city. The next day we traveled about 10 miles further, camping two miles beyond the ancient and miserable little village of Piscataway. The rate of marching depends entirely on the speed with which the forage wagons can keep up. The roads are very bad, the ground being mainly wet and swampy. About the only thing they raise is tobacco, every old barn is full of it, hanging up to dry, giving plenty of employment to our two cigar makers. Piscataway is fenced in; the last house was built about 50 years ago and it is against the law to build a house outside the fence. The graveyard is filled with graves of a hundred years ago. The land is all worn out and much of it is abandoned.

Our next day's march was to a swamp of ten miles length, the trees being principally cedar, pine and green holly full of

² An employee of John A. Roebling.

red berries; many of the holly trees were over a foot through and would be worth a hundred dollars in a city. That night we encamped within hearing distance of the guns of the rebel battery. The *Harriet Lane* was busy shelling them and burning their store-houses. The fourth day at last brought us to our present camping grounds at Budd's Ferry, about a mile from the river directly opposite the rebel battery at Shipping Point, the second one on the river, the Cock-pit Point Battery being above a few miles. If they knew our camp they would most likely shell us, as it is their shells have passed a mile beyond. The river here is a mile and a half wide. I have examined their battery pretty well with my glass. It is quite a heavy work, built up of sand-bags and clay, and protected by the high river bluffs behind, making it necessary to take the heights behind first, before the battery itself could be held, after driving the enemy out. The battery mounts three heavy guns; one gun throws a hundred-pound shell. They fire every day at the passing vessels of which they have hit none, beside sending a few shells across to our camps.

The Virginians seem to have built a railroad along the river some distance back of their battery by which they can throw a large force to any menaced point within a short time. You will therefore see by this system that the blockading of the river is very perfect. It is here that our gun boat flotilla on the river can drive the rebels out of every battery in a few hours, but as they are commanded by higher ground in the rear, the next day the rebels are back in full force. I saw the negroes today hard at work with pick and spade repairing damages across the river. We have three field batteries. There are about 13,000 men here, four firing squads, Sickels' brigade, and the balance New Englanders. I never expected them to come near a Jersey regiment and now we are close together.

THE ROEBLINGS

The Trenton boys were quite surprised to see us pop in on a sudden. The Fifth, you know has quite a number. None of them has seen army service yet of any account and consequently they look on me as an experienced campaigner. Jim Rusling³ showed me his war steed. He can take down any horse in the division and stand cannonading without wincing. I saw all the boys but Johnson, who is quartermaster of the Seventh. I have no idea what the division here intends to do; no preparations are being made for crossing, neither have they been ordered to go into winter quarters.

The country around here is very poor; no farm houses of any account, nothing but little negro cabins; these negroes living on bacon and corn bread all year around. Near Piscataway we passed a negro factory for the southern market, containing seventeen little negroes two feet high in a shanty about the size of a pig-pen and guarded by an old woman. They all turned out to look at us and so I had a chance to take notes.

The only white woman I have seen around here is Mrs. *General* Sickels, who rides around in full uniform, attended by a bodyguard of cavalry. While in Washington we exchanged our Hotchkiss shells by order of Berry for Shunkle percussion-shell. I hope we can try the latter before long. They are covered with *papier mâché* in place of lead, and when stripped of their covering, they look like a tad-pole. The percussion arrangement, however, is more certain.

Our slumbers were disturbed this morning about four o'clock by a terrific discharge from their battery; the stillness added to their effect. Their shell burst half a mile to the right of us behind a blacksmith shop. There is no fort here of any

³ James F. Rusling, of Trenton, 1st Lieutenant and regimental quartermaster, 5th New Jersey Volunteer Infantry, afterwards Brigadier General (brevet), U.S. Volunteers, February 16, 1866.

LETTERS FROM THE FIELD, 1861-1864

kind. A couple of rebel schooners are couped up in Quantico Creek opposite. The rebels are miserable shots. They fired thirty times at a schooner and succeeded in putting only one shot through the mainsail. Only two bay schooners have been lost thus far and they were located and taken by armed boats.

If anything interesting happens here I will keep you posted. Direct your letters to me, Bunting's Battery, Hooker's Division, Budd's Ferry, Maryland. We have no chance to see papers here so please send me some once in a while if there is interesting news. Give my love to all.

Budd's Ferry,
January 26, 1862.

Everything is jogging along here in the usual style; times are even duller than up at Poolesville. The other night a party of us gave a musical soiree at the widow Mason's house, down on the river bank. The music consisted of singing, piano, guitar and violin, your humble servant performing on the latter. The affair was topped by a supper, very creditable for this part of Maryland. Most of the furniture is removed from the house on account of the range from the battery. We had scarcely finished supper when the batteries opened on a propellor, two shells fell in the yard alongside the house, fortunately without bursting. The rebels have mounted a very large mortar. Our boys say it takes a yoke of oxen to draw in the ball and afterwards they walk out of the touchholes. Most of the regiment have lately been supplied with Austrian rifles, which came over in one of the Hamburg steamers. They are an excellent weapon.

The *Tribunes* which you send occasionally are very acceptable, as they are the only ones received in camp. I notice that all the papers are silent about our division. One of the gunboats here is covered with a sort of iron crating, intended prob-

THE ROEBLINGS

ably to keep off boarders, or else to keep out fragments of bursting shell. This is a splendid Sunday, clear and warm, reminding one of spring which will soon come. The bluebirds stay here all winter, as also the mocking-birds.

Do you know what Mr. Gowers address is? I should like to have it. I believe I have not thanked you yet for the cigars and do so now. They are the best I ever smoked. That jelly was also excellent; it came safe and sound.

The boys want me to take a hand in a game of whist so I must close, tell that gal Elvira⁴ I will answer in course of time, provided I ain't too lazy. I want some more emery-paper.

Budds Ferry,
February 20, 1862.

I received both your and "Ferdie's" letter today and note what you say in regard to that majority. I was not aware that a Tenth New Jersey regiment had come out as yet. I have not heard anything of Captain Murphy,⁵ either, as yet. I don't think I would accept his offer if it be made at all, because my present place suits me excellently well. Our new captain, Bramshall, has declined the other position offered to him, preferring to remain with this company, which is the best artillery company in this division, and that leaves things just as they were. We expect the appointment now every day, Bramshall's refusal having about had time to reach Albany. The officers in our battery would be very sorry to lose me and are opposed to my leaving very much. I have forgotten almost all the little infantry drill I used to know; the artillery is so much different.

⁴ His sister.

⁵ William R. Murphy of Trenton, Captain, Company A, 1st Regiment, National Guard, Mercer Brigade, New Jersey, afterwards Colonel 10th New Jersey Infantry, Volunteers.

LETTERS FROM THE FIELD, 1861-1864

Do you know whether any of the men for the regiment are arrived yet? I suppose they would have to remain in camp at Trenton for quite a while yet. General Berry will send down two Whitworth guns in a short time for the purpose of dismounting the guns of the rebels battery opposite, piece by piece. Bramshall will have charge of them and he has promised me the superintendency of them, provided they come, of course. The other New York battery in this division will probably be dismissed on account of inefficiency.

The balloon has been up for several days every afternoon making observations on the other side. Many of their troops have left of late, but they have about as many left as we have on this side.

Hooker is making efforts to go to Kentucky with this division, but I doubt whether he will succeed. I fired a few shots across the other day which hit very well. They replied without doing any damage. Roll-call, and I must close. Give my love to all.

Camp Dickinson,
March 9, 1862.
Budd's Ferry.

This Sunday has been the most eventful with us since we have been here. We were all sitting quietly in the sun making after dinner reflection, when the report was brought into camp that large quantities of smoke were visible on the other side. Immediately all available tree tops were manned by an eager crowd and the report was found to be true. The smoke and fire seemed to be increasing every moment, until, in a short time, all their camps, to the number of six or more, appeared one mass of smoke extending far up the Quantico. Presently flames began to shoot forth from the steamer *Page* and also from 3 schooners which she had captured in the beginning of their

THE ROEBLINGS

career. The former burnt to the waters' edge in a short time, her smoke stack disappearing very suddenly. By this time the flames had reached some of the magazines, resulting of course in some tremendous explosions. Some of their guns had been left in position, double shotted, and as the flames reached them they went off, the shots striking the bank on this side. Apparently no attempt has been made to remove the guns or any of their commissary or ordnance stores, the size and color of the flames indicating the burning of flour, forage and provisions, and, even now, nine o'clock, the sound of exploding shells falls on the ear. The gun-boats, ever on the alert, no sooner saw the first smoke before they came down opposite Cock-pit Point, reconnoitering. After throwing in a few shells and eliciting no reply, a detachment of marines was sent on shore who clambered up the steep bank, and finding the batteries deserted, immediately raised the flag of the Union. At Shipping Point, the strongest fort, the gun-boats proceeded much more cautiously, but no resistance was offered to the landing of a boat's crew, whose first act no doubt was to tear down an immense black effigy which has been hanging from a pole for a long time.

Last night two black deserters came over and reported that seven regiments had left that morning for Fredericksburg, and no doubt they were busy yesterday making preparations for a complete evacuation. By the arrival of the captain's father tonight from Washington we hear of the taking of Leesburg and the occupation of Centerville. It must have been the fear of having their rear cut off (Heintzelman) which made them decamp so suddenly. Tomorrow we will know all about the affairs on the other side because we expect to go over now as a matter of course. Nobody could have dreamt of this twenty-four hours ago, but now that it is all over we have relapsed into our usual indifference.

LETTERS FROM THE FIELD, 1861-1864

This morning the boys staked out a garden patch for the coming summer, but I fear that the only thing we could raise would be some of the pumpkins, the vines of which grow so rapidly that they overtook the boy that planted them before he got out of the field, and by the time he jumped over the fence he found a full grown pumpkin in his pocket.

General Hooker feels a little disappointed that the credit of reducing those batteries was thus snatched away from him. However, it is well enough as it goes. I got a letter from old Fisher asking me to give him all the details about the Whitworth gun. These guns are two miles from our camp and I doubt now whether I will have time to do it. Give my love to all.

Budd's Ferry, March 12, 1862.

I have just returned from a visit to the sacred soil of Secession. My visit was confined in extent to the Shipping Point Battery, the rain preventing a trip to Dumfries 5 miles up the Quantico. The battery is an immensely strong work, with banks at least 15" thick and provided with plenty of bomb-proof shelters. It would have been impossible for anything but the *Monitor* to dislodge them by an attack from the water. Their defenses in the rear were rather weak, but in the front they were next to impregnable. Their camps are very filthy concerns, most of their huts being burrowed in the hillside to the rear of the battery, so as to have bomb-proof roofs. Plenty of provisions are lying about, comprising beef, both raw and roasted, rice, potatoes, flour and cornmeal, dried apples and peaches, crackers, soap, coffee mills but no coffee; in fact all the necessities of life were present in abundance but no luxuries. Most of the guns were burst and all but 2 magazines, each of the guns had a separate magazine. Their cavalry pickets are plainly in sight only 3 miles off, but a small force has

THE ROEBLINGS

been sent over thus far, most of whom return at night. A large number of letters have been found; their uniform tenor is hard times, and harder times coming. All their old telegraphic dispatches were found at Dumfries. I saw one of Wigfall's to Gen. Holmes, asking for immediate reinforcements, because he expected an immediate attack.

At Dumfries only women remain, many of them very pretty. Dumfries is one of those ancient Virginia towns finished before the flood and on the decline ever since. I saw a contract dated 1760, between one Alex. Cunningham of Glasgow, Scotland, and his factor here in Virginia, binding the latter to send a certain number of cargoes of tobacco to Scotland every year. The document is ratified with tremendous seals.

Several masked batteries were discovered in unlooked-for places. On the whole we may congratulate ourselves that the rebels evacuated them; it would have been a bloody battle to take them.

Since yesterday morning an endless procession of steamers have passed up the river; it seems as if every river and ocean steamer on the Atlantic coast had been pressed into service from Maine to Fort Monroe. I have seen over fifty go up myself, enough to transport 40,000 men in one day. It looks as if they were going to give our division the go-by and we feel rather bad about it. I am sure, at any rate, that the rebels will rue the day when they abandoned this line of defenses. You may look out for some heavy movements within the next few days. I have understood that the *Monitor* was to have been immediately sent here after arriving at Fort Monroe, if it had not been for the *Merrimac*.

Budd's Ferry
April 30, 1862.

I received your letter in due time. Day after tomorrow we

LETTERS FROM THE FIELD, 1861-1864

leave from here for certain. Our destination being, most likely, the York River, in place of Fort Monroe itself. General McClellan was here last night, stopping to see General Hooker, and left at 5 this morning for Fort Monroe. I expect we go in schooners towed by steamer. The gun and limbers will have to be taken apart, and lowered in the hold, while the horses will stand on deck. They are sea-going schooners with high bulwarks so that the horses can't jump overboard as they did in crossing the river at Ball's Bluff. Troops are going down the river constantly. The big *Constitution* went down today. She can hold a brigade. I expect we will have a nice trip going down; the first job will be to take Yorktown; most likely the gun-boats will have to do most of it. The place is very well fortified.

Lieutenant Hall, of the regular battery here (the Fort Sumter man), says that the old fortifications, built by Cornwallis, are in good preservation yet and are perfect in construction. This same Hall was employed by Floyd two years in strengthening and enlarging these same fortifications, especially on the land side, showing that Floyd was working for Secession at that time. On the other hand it is a good thing that we have a man in the division who is perfectly familiar with them. It will be a great help to us, having such a man in the division.

I am glad to hear that my trunk arrived—that piece of fiddle music in it is quite a trophy. It used to belong to J. B. Floyd, and has his autograph on it. I had the second, but some damn thief stole it.

I scarcely know what directions to give you about my future address. I suppose Hooker's division, Heintzelman's Corps, near Fort Monroe or Yorktown will answer. I can probably send you better directions after we get to our destination. I wish the paymaster would come around; we haven't been paid since shortly after New Year's.

THE ROEBLINGS

Washington,
May 31, 1862.

I have not got away from here yet but expect to very shortly. On Wednesday I took all the ropes here over to Alexandria into the Manassas Depot on the dock, where they can be shipped either by cars or vessel to any point without any intermediate hauling. I have also got all the tools, blocks and tackle, rope, full stock of iron and four hundred bridge bolts; there. The bolts were made for me by Mr. Cheney at the government shops in Alexandria. He is an old friend of mine from Pittsburgh, formerly of the firm of Baldwin & Cheney. I shall ascertain tomorrow whether I go out the Manassas Road. Frémont you know is in Strasburg and McDowell within 15 miles of him, so, "good bye Jackson." The plans which I sent to Gen. Meigs—the written instructions—are being printed very nicely. The drawings are being engraved in Philadelphia. I have received several proof sheets already for correction. The engraving is done very well—500 copies are to be struck off. I wish they were done; it would save me a heap of trouble in the way of explaining to folks.

In moving the ropes to Alexandria the reels were pretty well smashed and I have a carpenter at work putting in slats; all slats having no backing under them are broken. The reels, on which the 400 feet lengths are, had better be wider and lower; they fall over on very slight provocation. The bottoms of all the army wagons used in hauling them were broken through. I met Emerson from Trenton, and Col. Murphy just after. My respects to all.

I have just heard some news from our boys through Maj. Webb⁶ who was there. He says the enemy killed 65 of our horses making it impossible to bring the battery forward, and

⁶ Major Webb, Paymaster, 5th New Jersey Volunteers.

LETTERS FROM THE FIELD, 1861-1864

that after the regulars had run away from their guns our boys went in and worked them until the end of the fight.

Washington,
June 9th, 1862.

I am stopping here on my way to Fredericksburg, where they have some idea of rebuilding the road-bridge across the Rappahannock, which was swept away. There are some eight spans, I believe. I also came to see what had become of the wire rope which I had intended to use at Forest Royal, and which had not arrived there when I left. I find that Gen. Meigs took it while I was away and sent it to Harper's Ferry, without my knowing anything about it, and as I was responsible for it, I was of course a little anxious about it, but it is all right now. I wonder if you ever sent those ropes to Maj. Clary. Who did you send along with the ferry rope to Harper's Ferry? Address me at Falmouth, Va., care Maj. D. G. Houston, Gen. McDowell's staff.

I have just heard that Jackson has been reinforced to 60,000 men and will once more drive everybody over the Potomac—he is a bully boy.

Fredericksburg,
June 1862.

I have been here now for a week without doing anything of any account, beyond making a plan for the proposed bridge here, in case they want it, which is questionable, because it will be the fourth bridge here. First there is the R.R. bridge, the canal-boat bridge and the pontoon bridge. All the bridge-builders—creation—are concentrated here. There is McCallum, chief of the R.Rds., next Col. Haupt, then Col. Stone and the balance of the former firm of McCallum Bristol & Co., and next are the Engineers with two pontoon bridges of 600 ft. each, and a portable trestle bridge. As a matter of course

THE ROEBLINGS

these bridge colonels are constantly at loggerheads with each other, each one wanting to have his own way. The bridge, which I may possibly put up, is 1023 ft. long, spans varying from 70 to 80 ft. so that I can get along with 3 ropes on each side. There will be no trouble about putting it up. Two of the piers are gone and have to be replaced by trestles. Planking is so very scarce here that they will most likely have to be sent down from Alexandria. You will also notice that on account of the length of the bridge I have not quite enough, and may have to order more.

Matters here are very dull, everybody is disgusted with the "standstill policy."

On the Tuesday of my arrival the last of McCall's Division had just left for Richmond, via York River. Shield's Division is also permanently detached, which leaves McDowell only two divisions; of these, the greater part of King's Division is here and the greater part of the other, which is Ord's old Division, is scattered from Front Royal to Catletts Station. Had Jackson waited one week, McDowell would have been with McClellan with 50,000 men. Now everything is knocked into a cocked hat. It is hinted that King's Division was ordered to Alexandria to embark from there to Richmond, but that he refused, threatening to resign with all his officers if they did not give him orders to march from here to Richmond over land. King is a trump.

I suppose you know that I have received no letter from home yet. Address me care, Maj. D. C. Houston, Gen. McDowell's staff. I am looking around for a horse now if I can find a cheap one.

Tell "Ferdie" to send me a box of Bower's two-cent Plantation cigars, direct by Adam's Express to Fredericksburg, with my name merely. It is hot here. Give my respects to all.

LETTERS FROM THE FIELD, 1861-1864

Harper's Ferry,
October 27, 1862.

Your kind letter of the 20th has been received. I have moved down to Harper's Ferry with Maj. Houston and am occupying a very decent 2½ story brick house, where we intend to make ourselves comfortable if possible. The Maj. has charge of the four forts which are being built here and will probably remain here until after New Year's. Most likely I shall be here as long too. Therefore address your letters direct to me at Harper's Ferry; the Post Office is almost next door. Your hopes that I will have good mechanics to build the bridge are vain, the only men that I can obtain are prisoners, and a very lazy set they are.

You speak about some ropes sent here which have never been paid for. They are lying in Washington and have never been used. I have one here which was ordered through Field & Haron. Let me know the name of the Q.M. who ordered them, and if he is around here, I may be able to make him settle for it. But the best way would be to state the whole case to Meigs who will most likely have it settled at once. Mr. Rhule has not appeared and I guess won't come.

There will be some fighting soon. Troops are moving down the east side of the Blue Ridge, and the heavy rain of yesterday and before will probably raise the Potomac sufficiently to relieve the large number of troops guarding it. I bet the next battle will be fought near Bull Run again. Give my love to all.

Hurry up the strands. It takes 10 days to reach me.

Harper's Ferry,
November 13, 1862.

Your last letter was received, announcing the shipment of wire and box, which however have not arrived as yet, owing no

THE ROEBLINGS

doubt to some carelessness on part of the B. & O. R.R. It generally takes three weeks for anything to get here from Washington, and correspondingly, 6 weeks from Trenton. I returned this evening from a trip to Baltimore to look after my bridge-timber which has only partly arrived as yet. It was well I did so, since I discovered that old Belger's clerks had made some horrible blunders in transferring my order to the Trenton men. For instance the lower floor plank which I had ordered 2 in. by 12 in. they changed to 12 in. by 12 in. and 5 cars were standing loaded with these big logs for planking the bridge; the loss of course falls on the Government.

Our dreams of quick happiness for the coming winter were suddenly dispelled by the receipt of an order from Gen. Halleck, appointing Maj. Houston chief eng. to Gen. Banks in the new expedition. He left yesterday very much to our regret. I shall most likely join him as soon as I get through here. Houston is a man of fine talents, graduated at the head of his class, and ranks among the first in the Engineer Corps.

On my return from Baltimore I met "Colly" Hall⁷ quite by chance at one of the stations. His regiment is engaged in the delightful duty of guarding a little R.R. bridge, a few miles from Frederick. They will probably stick there all winter.

I am short of funds at present and wish you would send me \$70 out of the office and a couple of blank M. & M. checks; I will send you a check for the amount filled up. There are over \$400 pay due me but no chance of getting it for at least five weeks to come, if not longer. Mr. Rhule has had the usual complaint arising from this hard Limestone Water here. By aid of a compress, and keeping quiet, he got over it. Give my love to all.

⁷ Caldwell K. Hall, of Trenton, Lieutenant Colonel, 14th Infantry, New Jersey Volunteers, subsequently brevetted Brigadier General.

LETTERS FROM THE FIELD, 1861-1864

Head Quarters 21st N.J. Vols.

near New Baltimore, Va.

November 14th, 1862.

We left Trenton on the twenty-fourth of September for Washington, D.C., at which place we arrived on the twenty-fifth. On the route we were handsomely received at Philadelphia, where we had a good dinner at the Soldiers Retreat. We went in Camp at East Capital Hill, Washington, where we stayed until the first of October. On the first of October we started for Frederick, Md., and arrived there on the morning of the second, where we encamped just outside of the city. Our camp was called Camp Hudson. We remained in Camp Hudson until the seventh, when we were ordered to report at Bakersville, a distance of twenty-two miles. We marched from Frederick at six o'clock in the afternoon, and arrived at Middletown at one o'clock a.m., where we encamped for the night. Some of the boys gave out before they had marched five miles, not being used to marching and being new men. We stayed at Middletown until five o'clock p.m., when we started on again and arrived at Boonsboro at 8 p.m., and encamped for the night. Next morning we started again at 8 a.m., and arrived at Bakersville 2 p.m. Here we met the New Jersey Brigade. On the 11th we were ordered to Hagerstown. Started at 7 a.m., and arrived there at 3:30 p.m., where we encamped. We stayed at Hagerstown about a week. We then started from Hagerstown and arrived at Clear Spring where we encamped.

Our regiment did picket duty, one company at a time, about three miles from Clear Spring, for four or five days. We were then ordered nearer the river, where we did picket duty two or three days. Our pickets were on one side of the river and the rebels the other. We then went to Williamsport where we stayed two days. Our men being now quite used to marching,

THE ROEBLINGS

marched very well. We then started on again and stopped at Boonsboro again, where we were mustered in for pay. We stayed over night at Boonsboro and started on again in the morning. We passed through Crampton's Pass, the scene of the late battle, arrived at Petersville in the afternoon, where we stayed two days. On the 3rd of November we started from Petersville and crossed the pontoon bridge at Berlin. Here we took our last look at Maryland, and crossed over into Virginia. We marched about six miles after crossing and then halted for the night. We started again the next day and arrived at White Plains, where we stayed two or three days. At this place we had quite a heavy fall of snow which lasted all day. We next started for this place. About three miles from where we are encamped our regiment was detailed for picket duty. We were apprehensive of the rebels falling on our rear, and it seems, we had a narrow escape, as there was a rebel brigade within a half a mile from us. We could see their camp-fire plainly from where we were on picket. The night passed without anything occurring and the next day we came to this place. We are encamped about five miles from Warrenton, where there is Railroad communication with Alexandria.

On the same sheet of paper there is a letter to Mr. Swan from a Colonel Houten, who had evidently been a recent guest at Mr. Swan's home in Trenton:

My time is so much occupied that it seemed almost as though I would never be able to write you, so this morning I set my nephew at work giving you a description of our marches, and will conclude by thanking you kindly for the interest you took in my family, and also, for the favor granted them in accommodating them while at Trenton. It appeared more like our own family while there than like strangers. I am fearful that you think us ungrateful for the kindness received

LETTERS FROM THE FIELD, 1861-1864

at your house but that is not the case. My letters from home have more than once called on me to write you but my time is taken up with other matters and that is the only excuse I can offer. My health has been first rate, the weather fine; we have had only two rain-storms and one snow-storm since we left Trenton. We are now about 5 miles from Warrenton, Va.

Our camp ground is very good, but Secession plenty; the country stripped of everything. We had a great review at the leaving of our "Little Mac,"⁸ the idol of the army. Things look gloomy but I trust for the best. I will not venture an opinion, hoping every thing will turn for the best. I should like you to write an answer to this and I will try to do better hereafter. Give my kindest regards to your wife and family. Direct Col. Urban Houten (?) 21st Regiment, 3rd Brigade, 2nd Division, 6th Army Corps. Washington, D.C., to be forwarded.

Washington,
January 12, 1863.

Having finished the bridge at Harper's Ferry I have come down here to get new orders from General Meigs, which I will probably receive in the course of a few days. In looking over the stock of wire ropes here, I find there are about 4 coils, No. 16, of 400; a 600 coil of No. 16 and 2 ferry ropes, one of them is No. 7 and has no length marked on it. From the weight of it I should judge there were about 1500 in the coil. The direction of the reel is Harper's Ferry, and, "Hurry up," is painted on the reel. I wish you would let me know the precise length, and direct your reply to Harper's Ferry, where I shall have to return to settle up. The bridge has turned out more solid and substantial than I at first anticipated; it is very stiff, even

⁸ General McClellan was relieved of his command November 7, 1862.

THE ROEBLINGS

without a truss railing, and has been pretty severely tested by cavalry and by heavy winds. The weather was so bad of late that the men could scarcely work half the time. You will notice from the stock of ropes, before mentioned, that the big lot which you made last May have dwindled down to very small dimensions.

I am sorry I did not make my cables a little stronger at Harper's Ferry, so as to be more in keeping with the rest of the bridge. I made a railing of No. 20 rope, using up about 1800 ft. of it, and also used No. 12 in place of 16 for stays.

I happened to meet Gen. McDowell today and he asked me about several things which had occurred in the Bull Run fight, where, on several occasions, I was the only staff officer that had stuck by him. The General looks very well and seems to thrive better under a Court of Inquiry than in the field. Most of his staff officers are here doing nothing. I am glad I am not one of them. Give my love to all.

Gen. Headquarters,
Army of the Potomac,
February 21, 1863.

I am finally settled down in my new quarters, or rather old ones, because I was around here before. Address me care of Lt. C. B. Comstock, Chief Eng., Gen. Hooker's Headquarters. I found on my arrival that Gen. Woodbury had directed me to do duty with Lt. Comstock, and therefore I have nothing to do directly with Gen. Woodbury; have not even seen him yet personally. I fortunately found shelter during the first two nights of my stay here with my old battery, who were encamped close by. They were all glad to see me of course; but many changes have taken place. Bramshall resigned last week and so the others want me back, of course, and intend to make

LETTERS FROM THE FIELD, 1861-1864

written application to that effect. I scarcely see it any longer in that light. Still it is wrong to deprive them of the use of any officer when they need the services of one. Under the arrangement, as it is at present, they cannot put any one in my place. The only way for me to get out of it, and still attend my present duties would be to get the appointment of additional quartermaster, with the rank of captain, from the President. With Gen. Meigs approval I suppose the thing could be put through, although too late to be acted on this session of Congress. I shall probably get an official communication from the officer now commanding the battery concerning the matter and shall then take further steps in regard to it.

There will be nothing for some time I think, in the way of building bridges, at least not here. I have not been here long enough yet to be able to make any guesses as to future movements, but smell a rat already. Old Joe Hooker is all the go down here with the army—what there is left of it. Give my love to all.

Headquarters, Army of the Potomac,
April 21, 1863.

As this is probably the last letter you will receive for some little time, I write to inform you that I am well and hope your family are (as Mr. Rhule would say). Tomorrow or day after, or some time subsequent, if we aren't licked we will be over the river at last. Had the weather been good we would probably have been over before now. The chances are about even, and if everyone has the same confidence that old Joe Hooker has, we will be sure to win. It will be a hard fight, much more severe than the previous one here, as everything depends on it. The crossing itself will not be so difficult as before, but the storming of that line of hills will cost men, as every point is

THE ROEBLINGS

more or less entrenched. If we are successful in the first battle we will be before Richmond in a week. About the being *in* it, I am not so certain, although I have a bet of ten dollars that we will be in it by the 15th. Had we crossed when it was last contemplated we might have been that far by this time. The cavalry has also had bad luck and is not up to time owing to the rain. It is absolutely necessary to move now before the time of so many men expires.

Give my love to all at home.

Send me a few stamps by and by. Letter to be addressed as usual.

Headquarters, Army of the Potomac,
Germantown, Aug. 5, 1863.

We are hard at our old work again, sitting still with all our might and main, and doing nothing worth talking about. No doubt Gen. Halleck is conceiving some almighty plan by which to crush the Rebellion at one blow. This standing still is the worst thing that could happen for us by all odds. No amount of future reinforcements will ever compensate us for it, because when an enemy is once on a retreat, don't stop until he absolutely compels you to, which was not the case here. After replenishing our supplies at Warrenton, which required 4 or 5 days, we should have pushed on and at least maintain the appearance of a pursuit, even if it did not amount to a real one. The present dodge seems to be to squat here until 30,000 conscripts are brought down. This will take at least 30 days; then we must wait 30 days longer until these fellows are drilled a little; then we will go ahead for say 20 or 25 miles and discover all at once that a single R. R. is unable to supply so large an army with provisions. That will compel a change of base, of course. If you were to ask the soldiers what base they want to

LETTERS FROM THE FIELD, 1861-1864

change to they would say "Washington" mighty quick; but that wouldn't do. Our program will no doubt be to strike across from some point on the Rapidan, so as to strike the Fredericksburg-Richmond R. R. about half-way between the two cities. This march cannot be accomplished without a heavy battle somewhere in the Virginia wilderness, say half-way between Chancellorsville and the North Anna. Successful or not in that battle, we will be sure to turn up not far from Fredericksburg at the beginning of winter.

Buford made a dash through Culpepper yesterday, but had to leave it again; but I think that in a few days our cavalry pickets will be along the banks of the Rapidan. In one respect this occupation of country is good because our army devastates the land like a cloud of locust, and compels the inhabitants to move farther into Virginia and thus become a burthen to the people there, or also they come north, which very few do. One thing is certain that this army will never take Richmond no matter who the generals are nor how large you make our army.

I received a letter from "Ferdie" and Elvira, with the toothbrush.

"Ferdie" writes half a page and then says, "I see Elvira is telling you all the news, so I had better close." Elvira likewise writes half a page and says, "I see Ferdie is telling you all the news so I had better close." So twixt them both you may readily imagine how much news they wrote.

Headquarters, Army of the Potomac,
August 12, 1863.

I am in receipt of your favor of last week and take note in regard to the Ky. Bridge. I have been making an estimate of the cost of an army bridge of 1350 span and 12" wide, which is wide enough to pass one wagon and horsemen alongside of

THE ROEBLINGS

it with ease. The cost of such a bridge will not fall much short of \$150,000 of which about \$120,000 will go for wire ropes, for cables, etc., alone. Moreover it would take until February to complete the bridge, mainly because it would be utterly impossible for you to furnish the necessary wire rope before New Year's. The bridge would therefore be not available before the next spring campaign, which may not suit the views of the Administration; moreover, Gen. Burnside cannot order the bridge to be built without the sanction of the Sec. of War and of the Council of War in Washington, authorizing the expense. In my opinion therefore the chances of building the bridge are rather slim.

I should like very well to go and build it. The bridge would be of immense assistance as regards the future prospects of the Ky. wire R. R. bridge, because a temporary bridge of the kind would have to be built, at any rate, in order to construct it. The Government would no doubt be glad to sell it finally to the R. R. Co. when the Government had got through using it; and it is this latter consideration which may influence the authorities to have it built after all.

Gen. Warren⁹ secured his commission as Maj. Gen. the other day, dating back to Chancellorsville; he will temporarily take command of the 2nd Corps; I shall go with him.

Address me for the present as usual.

Headquarters, 2nd Army Corps,
August 30, 1863.

Your kind favor of the 24th has just received my attentive perusal; I wish it had come a few moments earlier, because just when the mail came, Gen. Meigs, who had been paying us

⁹ General G. K. Warren of the 5th Corps. afterwards his brother-in-law.

LETTERS FROM THE FIELD, 1861-1864

a visit, went away, and I thus lost the opportunity of asking him at once about that affair in Ky.

You must be perfectly overwhelmed with cares and anxieties, with so much on your hands, but I have no doubt you will survive it all and come out all right at the end of the year. You are a safe man to bet on, because I know that you have never been stuck yet.

We are getting along finely, making the most of the dull times. Conscripts are coming in gradually and the extensive shooting is stopping desertion. There is one class of people to be pitied now, and that is the Abolitionists. "Old Jeff." has taken the wind out of their sails most effectually by his nigger proclamation. Good bye to slavery from now on.

You need not expect anything from us for some weeks to come yet; in the mean time, Gilmore, "Rosy,"¹⁰ etc., are keeping the ball a-rolling. From Burnside I don't expect so much; he belongs to the old "fuss and feathers" school but *nous verrons*.

U.S. Sanitary Commission

On the Potomac, May 12.

[Possibly after Battle of
the Wilderness, 1864.]

We are now on the Potomac and the steamer, *Daniel Webster*, storm-bound; it being so stormy and dark that we cannot go on to Washington, so we are now at anchor. We have about 400 wounded men on board. Dr. Corson is the only doctor on board. Nine of our party are with him. We carried every man on board ourselves and it was the hardest work to do it that I have done for many years. When we arrived at the wharf at Washington, at first we had the greatest difficulty to get down

¹⁰ General W. S. Rosecrans.

THE ROEBLINGS

to the front (which, however, we never reached). We got opposite to the Belle Plain early yesterday afternoon and had to stay on board 20 hours, before we could get ashore. After we got ashore no officer knew anything about us, or could tell us how to get to Fredericksburg, unless we walked, which is very ticklish business, as the guerillas captured 300 wounded soldiers the night before as they were on the road to Belle Plain from Fredericksburg, killing all the wounded and stealing all the ambulance horses. Four of our party, however, concluded to foot it to Fredericksburg; they left for there this P.M. The rest of us went to the wharf and were detailed to bring up the load we had on board. To do this we had no single convenience, no stretchers, stores, medicines, food or bedding. I got some bandages, whiskey, etc., from a surgeon here and Dr. Corson and myself have been busy all the evening dressing and bathing the wounds of the poor fellows on board. Some of them have had nothing to eat for four days, nor have they had their wounds dressed since they were dressed on the battlefield. We managed to make a few bucketsfull of gruel and gave our own crackers in to pass around among the wounded. They devoured it like wolves and seemed to be contented after that to lie in the filth and waste straw we have them lying on. The stench of their wounds is horrible, and the whole thing disgusting in the extreme. We have probably not seen anything compared to the battlefield itself.

If I knew I could stay here, without causing you much inconvenience, I would go back to Fredericksburg for some weeks and do all the good I can.

I saw a doctor this A.M. from the 5th Corps. He said that when he left there was nobody hurt on General Warren's staff except the Asst. Adj. General, who was wounded in the arm, but since then, or rather today, they have had a terrible battle.

LETTERS FROM THE FIELD, 1861-1864

We have heard the shooting all day as plain as we hear it when they are testing cannon at Lamberton. We have no news at all down here, but heard this morning that Butler had taken Richmond. I feel pretty tired and have to go around among the men before turning in, so I'll stop. I will come home as soon as we dispose of our men in Washington.

Headquarters, 5th Corps,
September 1, 1864.

Well Sir, how do you flourish now-a-days? Who are you going to vote for, "Old Abe" or "Little Mac"? I wonder if the N.J. soldiers can vote? There are none in this corps, so I don't care much. In the next place what do you think of my Emily?¹¹ Don't you think she is some? She writes to me that she has made "Ferdie" feel very bad; poor fellow, how I pity him. The only thing I fear is that she is so strong that she will be able to lick me in case we ever have a fight.

From the enclosed proclamation¹² you will see that Jeff.

¹¹ Miss Emily Warren, the sister of General G. K. Warren, the lady whom he afterwards married.

¹² A translation from the German of the document above referred to:

CONFEDERATE STATES OF AMERICA,
Adjutant-General and Inspectors Bureau,
Richmond, August 15, 1864.

GENERAL COMMAND NO. 65

As a result of various communications to the War Office of the Confederate States that a large number of foreigners, by false promises, cunning and deception, were induced to join the services of the United States, and that these people, after mature consideration, will gladly withdraw from a war that is being waged against a nation which has never given them the slightest pretext toward enmity; and it is known, moreover, that a great many inhabitants of the United States who, by conscription, are compelled to fight the Southern States;

Further: That the government of the Confederate States is informed that all possible obstacles are placed in the path of these people to evade the services forced upon them.

Therefore it is ordered: That all such foreigners and inhabitants of the United States who appear in the Confederate lines, shall have the advantage of the protection of the Confederate States, shall receive all means of maintenance,

THE ROEBLINGS

Davis has suddenly grown very fond of the Dutch in our army, he even offers to send them back to Germany free gratis, for nothing. How very kind!

We have a signal station between the two picket lines which we occupy in the daytime and they at night. Every day we leave a lot of our amnesty proclamations there which they carry off, and in return, they leave documents like the one enclosed, both in English and German. No one has deserted yet however on the strength of reading them.

In a few days now we expect Early¹³ back from the Valley, and then look out for a fight. We are building two large forts that will give him a warm reception should he attack us. Give my regards to Mrs. Swan.

October 5th, 1864.

Not having seen my name in the papers you have doubtless come to the sensible conclusion that I came out all right in the last skirmish. Otis Fisher¹⁴ was hit in the forehead by a musket ball, and died subsequently in the hospital, as I heard today. I think he was out of his mind most of the time after he was hit. He made the remark though, that his father having always said that he had no brains, he was glad of the opportunity to send him a thimblefull and prove to him that he had.

When troops behave badly and break, mounted officers are very much exposed in attempting to rally them, and that thing

and those who so desire, will be dispatched to the nearest border line, from which they can return to their home country.

By official command.

S. COOPER,

Adjutant-General and Inspector.

¹³ General Jubal A. Early, the Confederate raider in the Shenandoah Valley.

¹⁴ Otis Fisher of Trenton, son of Mark Fisher and brother of Clark Fisher, manufacturers of anvils; of the 8th Infantry, U.S.A., brevetted Major, September 30, 1864; died October 4, 1864, of wounds received in action September 30, 1864, at Poplar Spring Church, Virginia.

LETTERS FROM THE FIELD, 1861-1864

happens to the 9th Corps in almost every fight, more or less. Our own corps fought splendidly; a fort and line of entrenchments were carried by assault with very small loss, not more than 200 men. The 9th Corps then went on our left and when the enemy made their attack in the afternoon, the 9th broke and ran. Two brigades of our first division were sufficient then to drive the "rebs" back and lick them handsomely. The enemy attacked the right of our line the next morning and were repulsed with ease. I think that will end the fighting for the present, and we are now building forts on the ground gained. We have not reached the R.R. yet, nor even the Plankroad, and see no prospect of doing so this year. There are not men in the army to reach them and keep up the line. The line now is about 30 miles long, and if the enemy ever breaks through, we are gone up the spout.

Butler's attempt on Richmond will amount to nothing. A single *Monitor* could go up to Richmond and destroy it but no officer in the fleet dares undertake it. There is nothing in the way, as Butler is in front of Fort Darling and can keep that quiet.

The weather is still very warm but very healthy. Recruits are coming in quite lively and the army in general is slowly increasing. Give my love to everybody.

Headquarters, 5th Army Corps,
Office, Asst. Ajt. General.

December 13, 1864.

I wonder if it is half as cold up with you as it is down here; we have not had much snow here but lots of ice, at least two inches thick. Yesterday we returned from our big raid towards Weldon. We got as far as Hicksford, destroying the railroad from the Nottoway River to that point, a distance of 18 miles.

THE ROEBLINGS

The destruction was complete, and makes the Weldon road useless for at least 6 months to come. We had a very hard time of it, marching almost day and night for 6 days. There was not much fighting, as we moved too fast. The whole country through which we marched has been devastated, every house in the line of march was burnt, and every living thing killed, except women, and any quantity of niggers came in with us. The 5th Corps has a big reputation now for raiding, I can tell you.

We shall move again in a day or two to help old Butler on his side of the river. Some of his people have gone to Wilmington to try and take it in connection with the fleet. I expect it will be a fizzle.

Give my love to all.

CHAPTER XIII

THE FRUITFUL YEARS, 1865-1883

Marriage—Assists in Building Cincinnati-Covington Bridge, 1865-1867
—Builds and Completes the Brooklyn Bridge, 1870-1883—
Breakdown in Health—Heroic Service

UPON retiring from the army, Colonel Roebling married, January 18, 1865, Emily, the daughter of Sylvanus Warren, Cold Spring, New York, and the sister of his old commander, Major General Gouverneur K. Warren. He met his future wife while she was visiting her brother in a camp in Virginia. Mrs. Roebling was a woman of strong character and rare cultivation, with an almost masculine intellect. She was devoted to her husband and helped him greatly in all his enterprises. She nursed him through his long spells of illness, and when he was laid up and incapacitated for any active work on the Brooklyn Bridge, served as his amanuensis, and when he was too weak to confer personally with his subordinates, acted as his intermediary and thus acquired an intimate knowledge of the details of the great project in which he was engaged. Further mention of Mrs. Roebling's invaluable assistance to her husband during the building of the Brooklyn Bridge, at a time when he was suffering from the results of the painful shock to his constitution, brought about by his unmitigated labors, will be duly detailed when that point in his history is reached.

HELPS BUILD THE CINCINNATI-COVINGTON BRIDGE, 1865

In the early spring of 1865 Colonel Roebling went to Cincinnati to assist his father on the Cincinnati and Covington

THE ROEBLINGS

Bridge, the completion of which had been delayed by the war. He remained there until the early summer of 1867, when, after his father's appointment as chief engineer of the Brooklyn Bridge in that year, he went to Europe to study the principles of caisson foundations. He remained for a year and made a thorough study of the subject, visiting England, France and Germany and consulting the foremost engineers of those countries. It was during this period that Colonel Roebling's son and only child, John A. Roebling, 2nd, was born in Muhlhausen, Thuringia, November 21, 1867, the birthplace of his grandfather, for whom he was named.

There are only two or three letters written to Swan during the two years when Colonel Roebling was living in Cincinnati, or, at least, only these have survived.

The first letter, written March 16, 1865, and dated from Covington, gives his first impressions of the bridge:

"We arrived here in due season after staying in Pittsburgh until Monday afternoon. The trains in winter seem to be constantly behind on the Pa. R.R. We were only six hours behind time. The trip to this place was equally slow. The high water has played mischief here, knocked everything to pieces on the Covington side. It will take at least three weeks to repair the engines and make the other arrangements before any stone can be laid. The trestles were all carried away, and as the water is still very high we are building a susp. bridge out to the tower from the Kentucky shore, so as to get the stone to the tower.

"The size and magnitude of this work far surpasses any expectations I had formed of it. It is the highest thing in this country; the towers are so high that a person's neck aches looking up at them. It will take me about a week to get used to the dimensions of everything around here.

"I am boarding at the same place where G. boarded. This

THE FRUITFUL YEARS, 1865-1883

gentleman has not made his appearance yet; I wish he would as he has carried off all the keys to the various desks and offices. The board at my place is quite good and plenty of it; the hours also suit me very well, for working hours. The rooms are rather poor; they suit me well enough, but when it comes to two it may not do as well; that refers to my better half you understand. They charge \$7 per week. . . .

“Mr. Dobie in Pittsburgh was out of a job. He is tired of building gunboats. The Allegheny wharf was filled with coal oil barrels all the way under the bridge. The first fire would be sure to burn it up, and that will be sure to occur before the season is over, so they concluded to sheet-iron the bottom of the land span—a job for Dobie. There were one or two little repairs to make about the railing, otherwise the bridge looks very well indeed.”

On June 21 of the same year he writes concerning the progress:

“The masonry is getting along. In two months we raise the saddles on this side [Cincinnati]. The weather is hot as you may imagine. If the mill is going to stop you will have a fine chance to make a summer trip.”

There is no further letter from Cincinnati until April 21, 1867, and this is in reference to opening a wire rope store in New York:

“I have made an arrangement with Father to open a wire rope store in New York City, upon my return from Europe sometime next summer. It has become a matter of absolute necessity to do so and now is the time. I shall take young Riedel [Edmund Riedel, his cousin] along to act as clerk and helper in the store, put on sockets, splices and other jobs; perhaps I shall take another rigger along from here to do outdoor work. If I am to have a decent store it is necessary to be able

THE ROEBLINGS

to do all the little jobs that the business may bring along. It is not to be a mere office but a regular store with 20 or 30 coils where people can buy on the spot. . . .

“Our work here is dragging along slowly; it would take the whole year to finish everything. I shall leave here the first week in June whether we are done or not. Father goes tomorrow, a week. . . . I understand that unlimited supply of greenbacks has been stopped in the Trenton household. How is that?”

Besides the New York office, established in 1868, John A. Roebling's Sons' Company maintains today branch offices and warehouses in the following cities: Boston, Chicago, Philadelphia, Pittsburgh, Cleveland, Atlanta, San Francisco, Los Angeles, Portland (Oregon), and Seattle.

When the Colonel returned home from Europe in 1868 he assisted his father in preparing the plans and specifications for the great bridge and was able from the knowledge thus acquired to take up the work after his father's death and carry it forward to a successful completion.

BEGINS CONSTRUCTION OF THE BROOKLYN BRIDGE, 1870

An account follows of this vast undertaking which was to make the Roeblings famous as bridge engineers throughout the world, and, more particularly, to constitute a lasting memorial to Colonel Roebling's genius, fortitude and industry, exercised under the most untoward circumstances. As the preliminary history of the project up to the time of John A. Roebling's death has been given in a previous chapter, the present narrative is concerned with the actual construction of the bridge under his son Washington.

There is no intention of retelling here in detail the story of the Brooklyn Bridge, far less of attempting any description of



The Famous Brooklyn Bridge, the Most Remarkable Engineering Achievement of Its Day and, after Fifty Years, Still a Monument to the Roebling Genius



Wilhelm Hildenbrand, One of the Roebling Engineers Employed in Building the Brooklyn Bridge



Emily Warren, First Wife of Washington A. Roebling

THE FRUITFUL YEARS, 1865-1883

the engineering problems which its construction involved, or the means whereby they were successfully solved. This book is primarily concerned with personalities rather than with things, except in so far as the material structures, which the Roeblings have conceived and built, serve to illustrate their genius, foresight and industry.

The literature on the subject of the great bridge is voluminous and varied. In the card catalogue of the New York Public Library alone the files of books, magazine articles and pamphlets relating to the bridge number over one hundred items. In addition the files of the metropolitan daily newspapers during the period of construction, 1870-1883, provide an almost inexhaustible supply of information about the bridge and cognate subjects.

Perhaps the best popular history of the bridge is the one which appeared in *Harper's Magazine* for May 1883, and which was subsequently reprinted in the *Franklin Square Library*. "The Bridge as a Monument," written by Montgomery Schuyler, printed in *Harper's Weekly* May 27, 1883, and likewise reprinted in the *Library*, provides a satisfactory critique of the bridge from architectural and aesthetic standpoints. In the supplement of the *Scientific American* for July 14, 1883, there is a detailed description of the engineering and mechanical aspects of the bridge. All these articles may be profitably consulted by those who may wish information supplementary to that provided in the present chapter.

GREAT PUBLIC INTEREST IN THE PROJECT

Probably no great public work undertaken in this country, either before or after, has called forth such a mass of printed matter, or engaged the literary activities of so many writers on every aspect of the subject, as has the Brooklyn Bridge. Since

THE ROEBLINGS

it was completed in 1883, other and bigger structures of a similar nature have come into existence, but none has ever surpassed it, if indeed equalled it, in sustained public interest.

We are accustomed today to contemplate huge enterprises of a material character and we have long ceased to wonder at them, but during the 1870's and early 1880's the two massive stone towers on either side of the East River, and the slender gossamer of wire connecting them, were an unfailing source of wonder and admiration to the multitudes which daily viewed them, either in the course of their erection or as a completed whole. As seen from the harbor and from the river the big bridge was a spectacle which dwarfed every other landmark. Visitors to New York, whether coming from other parts of this country or from abroad, were eager to feast their eyes upon the great work of which they had heard so much, and returned home to recount for others less favored than themselves the splendor of the vision which had enraptured them.

Poets and poetasters wrote verses about the bridge and, according to their talents, sung its praises in mellifluous or halting rhyme. Prose writers revelled in dithyrambic descriptions of its beauty and majesty and declared it to be the "eighth wonder of the world." Painters, etchers and engravers portrayed it from all points of view and under changing atmospheric conditions, both at day and night. The utilitarian-minded dwelt upon its practical aspects, as a means of communication between two growing cities, and statisticians estimated the probable number of those who would make daily use of it in going to and from their homes. Engineers and technical folk discussed the mechanical problems which its construction involved, and estimated the limits of its capacity to carry the burdens likely to be imposed upon it as the years went by, and computed the potential duration of its useful ex-

THE FRUITFUL YEARS, 1865-1883

istence. Dare-devils hailed it as furnishing a theatrical arena for displaying their adventurous deeds, and prospective candidates for suicide contemplated it as a convenient point of departure for another and presumably better sphere.

To the generation under whose eyes this engineering prodigy, this majestic work of human achievement, came into being there was and had been nothing to compare with it since the days of the Pyramids or the mythical Colossus of Rhodes. Of all suspension bridges in the world the Brooklyn Bridge was then the longest and greatest, nor could the most stimulated imagination conceive anything likely to surpass it.

There were at that time, be it remembered, no Empire State Buildings, nor Woolworth towers, to "prop the speckless sky," and the slender spire of Trinity Church, outtopping all the surrounding buildings, was in plain view from Brooklyn and the adjacent Jersey flats. Indeed, from Eagle Rock in the Orange Mountains, a distance of fifteen miles, its needle point was clearly discernible. All this was only about fifty years ago; and today there is another bridge, this time over the Hudson River, twice its span and more than double its weight and size, yet popular wonder and surprise find small occasion for utterance.

COLONEL ROEBLING SUCCEEDS HIS FATHER AS CHIEF ENGINEER

When Colonel Roebling assumed charge of the work in 1870 he was then in the thirty-third year of his age and had had an engineering experience, civil and military, of some thirteen years. With the exception of his four years in the army, he had worked with his father, since his graduation in 1857, on all the projects in which John A. Roebling had been engaged, including the Allegheny Bridge and the Cincinnati-Covington Bridge. In preparation for the caisson work on the Brooklyn Bridge, as

THE ROEBLINGS

soon as the services of his father had been engaged in 1867, he had gone abroad and spent a year there in an exhaustive study of the subject. Since his return he had been his father's chief assistant and had made himself intimately acquainted with all the ramifications of the general scheme, as his father's mind had conceived it, and was therefore the logical man to be chosen to carry on the work which his father had initiated, but of which nothing of a practical character had yet been accomplished, not so much as a spadeful of dirt dug for the foundation of the towers.

At the time of his father's death Colonel Roebling was living in Brooklyn in order to be conveniently near the scene of his daily labors. Within one month following his father's death Colonel Roebling was appointed chief engineer of the bridge. There seems to have been no hesitation on the part of the directors in making their choice nor any serious thought of selecting anyone else. As one of the speakers at the opening exercises on the completion of the bridge observed: "The son did not succeed the father by inheritance merely. The elder Roebling, according to his own statements, would not have undertaken the conduct of this work at his age—and he was independent of any professional gain—if it were not for the fact, as he frequently stated, that he had a son who was entirely capable of building this bridge. Indeed, the elder Roebling advised that the son, who was destined to carry on and complete the work, should be placed in chief authority at the beginning."

Ground was broken for the Brooklyn towers January 3, 1870, and for the New York towers two years later.

THE CONSTRUCTION OF THE CAISSONS

The chief engineering difficulty connected with the construction of the bridge was the sinking of the pneumatic caisson foundations for the towers.

THE FRUITFUL YEARS, 1865-1883

A caisson is practically a box of timber open at the bottom, which rests on the river bed. The water is kept out by pumping compressed air into the caisson. While the men working in the compressed air dig out the earth underneath, others in the open air on top of the caisson lay the masonry of the towers. As the towers rise, their weight, together with the removal of earth from underneath, causes the caissons to sink gradually to their final resting place at the bottom of the river. Every foot that the caissons sink necessitates an increase in the air pressure in which the men are working, and there is always danger, unless the utmost precautions are taken, of what is known as the dreaded "caisson disease," or "bends," developing among those employed in working in the high-pressure atmosphere.

The method of utilizing caisson foundations to support huge masses of masonry, which go down far below the water line, was one well known to engineers, and Colonel Roebling's previous studies had made him entirely familiar with the theory, but he had had no experience with its practical working, as indeed had few engineers at that time in this country. His problem was to sink his caisson deep below the bed of the river, and after pumping out the water and mud, to fill the cavity thus created with cement and superimpose upon the foundation thus laid, 70,000 tons of stone masonry. This work had to be done under the conditions of a tide which rose and fell as much as seven and a half feet. It was an operation which gave the engineers much anxiety, for upon its successful accomplishment depended the whole scheme of the towers, which had to be located beyond the shore line so as not to encroach upon the land, and thus unduly lengthen the bridge span, which, even if practical, would have enormously increased the expense.

The conditions on the Brooklyn side presented no special

THE ROEBLINGS

difficulties in the matter of sinking the caissons. Borings made previously showed gneiss rock at a depth of 96 feet below high water, above which were layers of hardpan and trap boulders, embedded in clay and sand. This was considered compact enough to form a satisfactory foundation without going more than 45 or 50 feet below the surface of the water. On the New York side harder conditions were found. Borings on this side did not encounter rock before reaching a depth of from 72 to 93 feet below high water, and, as extensive beds of quicksand rested on the rock, it was necessary to go down to it for a firm foundation.

Both caissons were finally installed, but not without casualties to the workers, nearly one hundred of whom suffered more or less during the operation from seizures of "caisson disease," though it proved fatal only in three instances.

Colonel Roebling himself was constantly in the caisson chambers overseeing the work. It was feared that the incessant blasting necessary would kill or injure the workers, and Roebling experimented by firing off revolver shots to test their effect. No one was injured and the work proceeded, but at a slow pace. "In place of one month, five," as he said, "were required and these were five months of incessant worry and toil, everlasting breaking down and repairing, and constant study where to improve if possible."

There were several accidents in the caissons, though no one was killed. At one time, luckily on a Sunday, when no one was working, the air got into one of the water shafts and blew the water out with a roar that alarmed all in the neighborhood. A column of mud and rock was propelled five hundred feet into the air. Once the supply shaft blew out while Colonel Roebling himself was in the caisson; he relates the effect:

"The noise was so deafening that no voice could be heard.

THE FRUITFUL YEARS, 1865-1883

The setting free of water vapor from the rarefying air produced a dark, impenetrable cloud of mist and extinguished all the lights. No man knew where he was going; all ran against pillars or posts or fell over each other in the darkness. The water rose to our knees and we supposed of course that the river had broken in."

With the intrepidity and resourcefulness which always animated him in emergencies, Colonel Roebling himself managed to close the doors which had been blown open and thus saved the day.

At another time the caisson timbers on the Brooklyn side caught fire and could not be put out by the means at hand. The only alternative was to flood the caisson, which Colonel Roebling ordered to be done.

COLONEL ROEBLING STRICKEN IN HEALTH, 1872

Colonel Roebling's excessive devotion to the work at this critical period, joined to the fact that he spent more hours out of the twenty-four in the compressed air of the caissons than anyone else, wore out his strength, and one afternoon in the spring of 1872 he was brought up out of the New York caisson nearly insensible, and all night his death was hourly expected.

In a few days he rallied and was back on the work again. He was, however, no longer able to labor as he had done before, and by December of that year he found himself too ill to go down to the bridge any more. Fearing that he might not live to finish the work himself, and knowing how incomplete the plans and instructions for the completion of the bridge still were, he spent the whole winter writing and drawing, and the papers, written while he was too sick to leave his room, contained the most minute and exact directions for making the cables and the

THE ROEBLINGS

erection of all the complicated parts which compose the superstructure.

Writing so much in his enfeebled condition impaired his eyesight. He was too weak to carry on a long conversation with his assistants.

Probably no great project was ever conducted by a man who had to work under so many disadvantages. It could not have been accomplished but for the unselfish devotion of his assistant engineers. Each man had a certain department in charge, and they united with all their energies to have their work properly done according to Colonel Roebling's plans and wishes, and not to carry out any pet theories of their own. But, beyond all others, he was aided by his wife, whose devotion and tact, when he was almost helpless except for his active brain, kept him in touch and communication with the outside world.

A writer in a recent issue of the *New York Times* relates from his own knowledge an incident which occurred during the period when Colonel Roebling was ill and confined to his rooms in the house which he occupied on Columbia Heights, Brooklyn:

"More than fifty years ago, when physically incapacitated, but yet mentally alert, an attempt was made to displace him [Colonel Roebling] in the management of the Brooklyn Bridge. . . . The writer distinctly remembers hearing him dictate to his wife a final statement, after many dictations, telling what he was doing on the bridge and why he should not be displaced. Mrs. Roebling read this paper before the American Society of Civil Engineers, in the American Institute Fair Building, at 63rd Street and Third Avenue. It produced an immense sensation, because it was a splendid statement and well delivered by Mrs. Roebling, who was young and handsome. It was also

THE FRUITFUL YEARS, 1865-1883

well received, which was not always the case at that time when a woman spoke in public.”

A TESTIMONIAL TO THE SERVICES OF MRS. WASHINGTON A. ROEBLING

A felicitous tribute to Mrs. Roebling, as representing the spirit of womanly love and devotion forever associated with the history of the great bridge, and serving as the gracious intermediary of its directing intelligence, was paid by Abram S. Hewitt in the course of his speech at the opening exercises:

“In ancient times, when great works were constructed, a goddess was chosen to whose tender care they were dedicated. Thus the ruins of the Acropolis today recall the name of Pallas Athene to an admiring world. In the Middle Ages the blessing of some saint was invoked to protect from the rude attacks of the barbarians and the destructive hand of time, the building erected by man’s devotion to the worship of God, so with this bridge will ever be coupled the thought of one, through the subtle alembic of whose brain and by whose facile fingers communication was maintained between the directing power of its construction and the obedient agencies of its execution. It is thus an everlasting monument to the self-sacrificing devotion of woman and of her capacity for that higher education from which she has been too long debarred. The name of Emily Warren Roebling will thus be inseparably associated with all that is admirable in human nature and all that is wonderful in the constructive world of art.”

Referring to Colonel Roebling’s great work on the bridge, and the credit due to him for bringing the enterprise to a successful conclusion, the speaker on the same occasion paid him the following eloquent tribute:

“To the mind which for fourteen years has watched, guided

THE ROEBLINGS

and governed the work, looking out upon it through physical organs almost fatally smitten in its prosecution, we bring our eager and unanimous tribute of honor and applause. He who took up, elaborated and has brought to fulfilment the plans of the father, whose own life had been sacrificed in their furtherance, has builded to both the noblest memorial. He may with truth have said heretofore, as the furnaces have glowed from which this welded network has come, in the words of Schiller's 'Lay of the Bell':

Deep hid within the nether cell
What force with fire is smouldering thus?
In yonder airy towers shall dwell
And witness far and wide for us.

"He may at this hour add for himself the lines which the poet hears from the lips of the House-Master:

My soul is built upon a rock
And sees unmoved the stormy shock
Of waves that fret below.

"It must be a superlative moment in life, when one stands on a structure as majestic as this, which was at first a mere thought in the brain, which was afterwards a plan on the paper, and which has been transported hither from quarry and mine, from woodyard and workshop, on the point of his pencil."

With the caissons successfully completed under his immediate supervision, a task which Colonel Roebling always regarded as the most critical part of the whole work, his physical presence on the scene during the years which followed was no longer possible. He continued at intervals to remain near the scene and thus kept in close touch through his subordinates with all that was being done. In the summer of 1873 he went abroad for several months in a vain quest to recover his shattered health. But if the personal presence and immediate over-

THE FRUITFUL YEARS, 1865-1883

sight of the chief engineer was henceforth impossible during the succeeding years, the work on the bridge nevertheless steadily went forward in strict accordance with the plans he had made, modified, as they had to be from time to time, to meet the new problems which constantly arose. When he was able to do so he sat at his window, which commanded an unobstructed view of the bridge, and watched through a telescope the building of the towers and later the stringing of the cables. Though absent in the body it was still his spirit that prevailed and his brain which directed the work. The bridge was his by right of inheritance, and by his own arduous labors. He loved it only as a man can love the cherished child of his brain for which he had been content to sacrifice his young manhood's strength and energy.

The two towers were completed in the summer of 1876, four years after his collapse. Then began the work of stringing the cables.

THE FIRST STRAND CONNECTING NEW YORK AND BROOKLYN, 1876

On August 14, 1876, the first slender wire was strung from tower to tower, and New York and Brooklyn at last had direct over-water connection. People were thrilled as they breathlessly watched the intrepid adventurers imperilling their lives, as it was supposed, by riding out on an almost invisible thread of wire, hanging 270 feet above the river from the summit of the towers. It required another seven years to complete this part of the work, which went on daily in summer's heat and winter's cold, until finished, and New York and Brooklyn were united by a spacious roadway, across which millions upon millions were to pass in the years that should follow.

It is apart from the purpose of this chapter to relate the

THE ROEBLINGS

details of this work, or to describe the ingenious methods employed in weaving the strands and stringing the cables. There were accidents and delays, but they were met and overcome by the courageous and loyal spirit which animated the rank and file of the workers.

The personal element in this narrative would not be complete without a mention of the names of those who were conspicuous for their labors and achievements, whether as chiefs or subordinates. Again, quoting the words of Mr. Hewitt:

“They are: John A. Roebling, who conceived the project and formulated the plan of the bridge; Washington A. Roebling, who, inheriting his father’s genius and more than his father’s knowledge and skill, has directed the execution of the great work from its inception to its completion; aided in the several departments by Charles C. Martin, Francis Collingwood, William H. Payne, George W. McNally, Wilhelm Hildenbrand and Samuel R. Probasco, as assistant engineers; and, as foremen, by E. F. Farrington, Arthur V. Abbott, William Van der Bosch, Charles Young and Harry Tupples, who, in apparently subordinate positions, have shown themselves peculiarly fitted to command, because they have known how to serve. But the record would not be complete without reference to the unnamed men by whose unflinching courage, in the depths of the caissons and upon the suspended wires, the work was carried on, amid storms and accidents, and dangers sufficient to appall the stoutest heart. To them we can only render the tribute which history accords to those who fight as privates in the battles of freedom, with all the more devotion and patriotism, because their names will never be known by the world whose benefactors they are.”

During the thirteen years in which the bridge was in course of construction there were fatal accidents to some twenty men

THE FRUITFUL YEARS, 1865-1883

only. Besides the fire in the Brooklyn caisson, in which no lives were lost, and the fall of the derricks on the Brooklyn side, by which several men were fatally injured, three died from "caisson fever," and still others were killed in the greatest accident of all.

On June 19, 1878, one of the great strands broke loose from the New York anchorage, carrying with it the "shoe" and its ponderous attachments. As the end swept from the anchorage it dashed off several men at work and then with a frightful plunge, grazing the houses and the busy street below, it landed in the bridge-yard, close under the New York tower. The great weight midstream whizzed it over the tower with frightful and increasing rapidity and the whole span plunged madly into the river, narrowly missing the ferry-boats, crowded with passengers, below the line of the bridge.

Perhaps it may be interesting in this connection, and by way of comparison with present-day wage scales, to give the schedule of the average wages paid to the bridge workers. These taken from official sources are:

	Average
Laborers	\$1.75 per day
Blacksmiths	3.50 to 4.00 per day
Carpenters	3.00 to 3.50 per day
Masons and stone cutters	3.50 to 4.00 per day
Riggers	2.00 to 2.50 per day
Painters	2.00 to 3.50 per day

The labor on the bridge was not by contract but by day's work.

Here in a condensed form are some of the most interesting measurements:

Length of river span, 1,595 feet 6 inches.

Length of each land span, 930 feet, 1,860 feet.

THE ROEBLINGS

Length of Brooklyn approach, 971 feet.

Length of New York approach, 1,562 feet 6 inches.

Total length of bridge, 5,989 feet.

Width of bridge, 85 feet.

Number of cables, 4.

Diameter of each cable, $15\frac{1}{2}$ inches.

Ultimate strength of each cable, 11,200 tons.

Depth of tower foundations below high water, Brooklyn, 45 feet.

Depth of tower foundations below high water, New York, 78 feet.

Size of tower at high-water line, 140x59 feet.

Total height of tower above high water, 277 feet.

Clear height of bridge in center of river span above high water at 50 degrees F., 135 feet.

Height of floor at tower above high water, 119 feet 3 inches.

Grade of roadway, $3\frac{1}{4}$ feet in 100 feet.

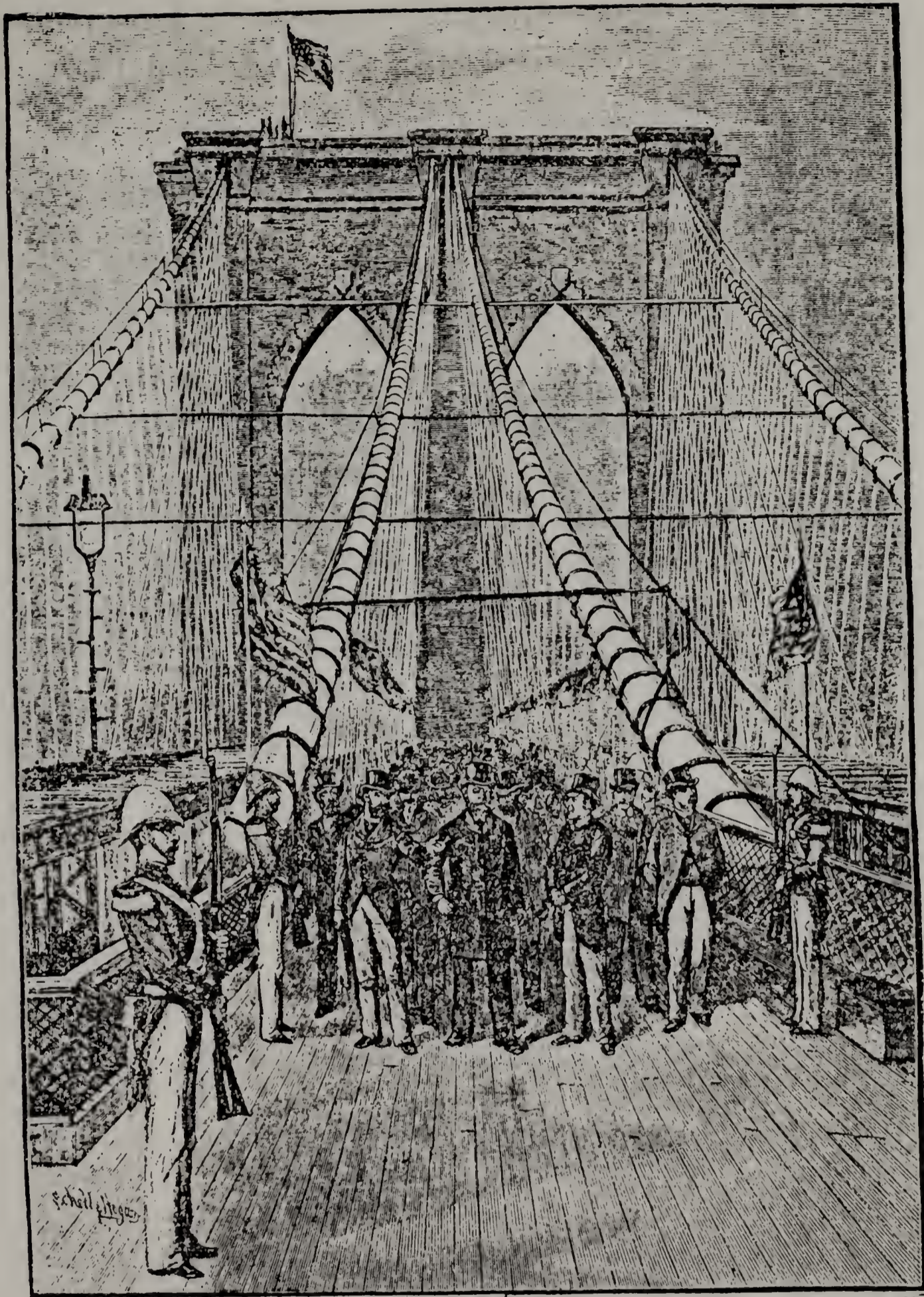
Size of anchorage at base, 129 feet by 119 feet.

Size of anchorage at top, 117 feet by 104 feet.

Weight of each anchor plate, 23 tons.

THE CELEBRATION OF THE OPENING OF THE BRIDGE, 1883

An abbreviated account of the formal ceremonies held in connection with the opening of the bridge will perhaps be appreciated by many readers. The day set apart was May 24, 1883. Both New York and Brooklyn were agog over the great event and huge crowds assembled to witness the spectacle. Official invitations to attend the celebration had been sent to the principal officials of the Federal government, to officers of high rank in the Army and Navy, to the heads of State governments and to the representatives in this country of foreign governments. Among those who accepted the invitation were



Reproduced from Harper's Franklin Square Library, June 22, 1883

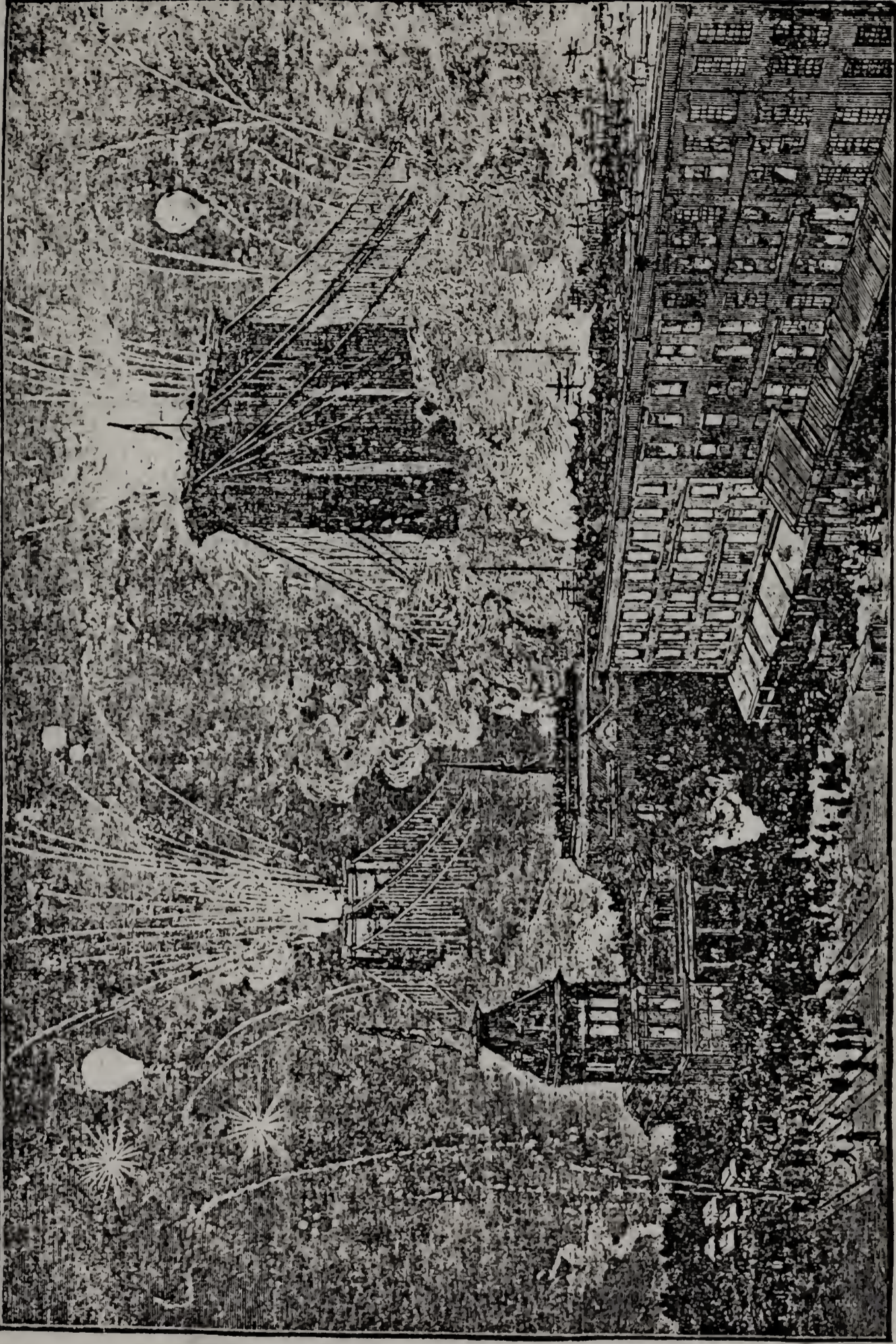
President Arthur and His Party Crossing the Bridge

THE ROEBLINGS

President Arthur and the members of his Cabinet, the Governor of New York, the Governor of New Jersey, the Governor of Rhode Island, and a large number of officers of the Army and Navy.

At half-past one the President and his party arrived at the City Hall in New York. Soon after a procession was formed and the gates of the bridge were opened, the 7th Regiment acting as the escort of the visitors. At the tower, which forms the entrance to the river span, the visitors were received by the trustees of the bridge, headed by Mr. William C. Kingsley, acting president. Between the two towers, the 5th United States Artillery was drawn up and on the Brooklyn land span the 23rd Regiment of Brooklyn. As the procession crossed the bridge a salute was fired from six men-of-war anchored in line below the bridge. The visitors proceeded to the station building at the Brooklyn entrance, which had been fitted with seats for 2,500 persons and platforms for distinguished visitors, the trustees of the bridge, the clergy and the speakers. The ceremonies were presided over by Mr. James S. T. Stranahan. Prayer was offered by Bishop Littlejohn of the Long Island diocese, and brief speeches of presentation by Mr. Kingsley and of acceptance by Mayor Seth Low of Brooklyn, and Mayor Franklin Edson of New York, followed. Then Mr. Abram S. Hewitt was introduced, who made one of the two orations of the occasion. He was followed by the Rev. Dr. Richard S. Storrs, as the other speaker.

A reception to the President of the United States and the Governor of New York, Grover Cleveland, was given in the evening by the City of Brooklyn, at the Academy of Music. Beginning at 8 o'clock there was a brilliant display of fireworks from the center of the bridge and from the summits of the towers.



Reproduced from Harper's Franklin Square Library, June 22, 1883

The Fireworks and Illuminations Celebrating the Opening of the Brooklyn Bridge

THE ROEBLINGS

Colonel Roebling, owing to his disabilities, was not able to attend the celebration, but during the afternoon received at his home, No. 110 Columbia Heights, visits from President Arthur and other dignitaries who called to offer their congratulations.

“THE BRIDGE AS A MONUMENT”

This chapter may fitly conclude with some passages from “The Bridge as a Monument,” written by Montgomery Schuyler, well known as an architectural critic, and first published in *Harper's Weekly* May 27, 1883.

After drawing a comparison with other great bridges in this country and abroad, the writer proceeded:

“The Brooklyn Bridge is thus one of the mechanical wonders of the world, one of the greatest and most characteristic of the monuments of the nineteenth century. Its towers, at least, bid fair to outlast every structure of which they command a view. Everybody recalls Macauley's prophecy of the time, ‘when some traveller from New Zealand shall, in the midst of a vast solitude, take his stand upon a broken arch of London Bridge to sketch the ruins of St. Paul's.’ But when our New Zealander takes his stand over the saddles that are now ridden by the cables of the bridge, to look over the site of a forsaken city, there will be no ruins of churches—at least of churches now in being—for him to sketch or see. The net of woven steel that now hangs between the stark masses of the towers may have disappeared, its slender filaments rusted into nothingness under the slow corrosion of the centuries. Its builders and the generation for which they wrought may have been as long forgotten as are now the builders of the Pyramids, whereof the traveller, ‘as he paceth amazedly those deserts,’

asks the Historic Muse, who builded them; and she mumbleth something, but what it is he heareth not.

“It is not unimaginable that our future archeologist, looking from one of these towers upon the solitude of a mastless river and a dispeopled land, may have no other means of reconstructing our civilization than that which is furnished by the tower on which he stands.”

After some critical remarks, dealing with the bridge from an aesthetic standpoint, and mildly censuring the engineer for his failure to take into consideration aspects of structural beauty in the towers, the writer continues:

“Vulgarity certainly cannot be charged against any integral portion of the great work itself. There is nothing frivolous and nothing ostentatious, even in the details which we have noted, and in which we have not so much been criticizing the crowning work of a great engineer as noting the spirit of our age. . . . We have complained of the lack of expression in the towers of their anatomy, but this is anatomy only, a skeletonized structure, in which, as in a scientific diagram, we see—even the layman sees—the interplay of forces represented by an abstraction of lines. What monument of any architecture can speak its story more clearly and more forcibly than this gossamer architecture, through which its purpose like ‘the spider’s touch’—

So exquisitely fine,
Feels at each thread and lives along the line.

This aerial bow, as it hangs between the busy cities, ‘curving on a sky imbrued with color,’ is perfect as an organism of nature. It is an organism of nature. There was no question in the mind of its designer of ‘good taste’ or of appearance. He learned the law that struck its curves, the law that fixed the strength and the relations of its parts, and he applied the law.

THE ROEBLINGS

His work is beautiful, as the work of a shipbuilder is unfailingly beautiful in the forms and outlines in which he is only studying, 'what the water likes,' without a thought of beauty, and as it is almost unfailingly ugly when he does what he likes for the sake of beauty.

"The designer of the Brooklyn Bridge has made a beautiful structure out of an exquisite refinement of utility, in a work in which the lines of forces constitute the structure."

A PARTIAL BIBLIOGRAPHY RELATING TO THE BROOKLYN BRIDGE, ON FILE IN THE NEW YORK PUBLIC LIBRARY

Report of J. A. Roebling to the President and Directors of the New York Bridge Company on the proposed East River Bridge. Brooklyn, 1867. 48pp.

New York Bridge Company. An Act to Incorporate the Company. New York, 1867. 7pp.

Report of the Board of Consulting Engineers to the Directors of the New York Bridge Company. Brooklyn, 1869. 15pp.

Report of John A. Roebling to the President of the New York Bridge Company on the proposed East River Bridge. Brooklyn: Daily Eagle Print, 1870. 48pp.

Annual reports of the Chief Engineer and General Superintendent of the East River Bridge, June 12, 1870. Brooklyn: Eagle Book and Job Printing Department, 1870. 24pp.

Report of the Chief Engineer and General Superintendent to the Board of Directors of the New York Bridge Company, June 5, 1871. Brooklyn: Eagle Book and Job Printing Department, 1871. 57pp.

Roebling, Washington Augustus. Pneumatic Tower Foundations of the East River Suspension Bridge, New York. G. W. Averell, New York, 1872. 92pp., 7 plans, 5pl.

New York Bridge Company. Report of the Chief Engineer

THE FRUITFUL YEARS, 1865-1883

of East River Bridge on Prices of Materials and Estimated Cost of the Structure, June 28, 1872. Brooklyn: Eagle, 1872. 15pp.

Reports of the Executive Committee and Treasurer. Brooklyn, 1872. 75pp.

Report of the Executive Committee, General Superintendent, and Treasurer. 1872-1873, 1873-1874.

New York Bridge Company. Report of the General Superintendent of the New York Bridge Company. Brooklyn: Eagle Book and Job Printing Department, 1873.

New York Bridge Company. Report of the Executive Committee of the East River Bridge on the Cost of the Structure and Land. December 1873. Brooklyn: Eagle Print, 1873.

New York State Statutes. Acts of the State of New York and of the United States, in Relation to the New York and Brooklyn Bridge. n.p. (1875). 21pp.

Report of the Officers of the New York Bridge Company to the Board of Directors. February 1875. Brooklyn: Eagle Print, 1875. 13pp.

New York City, Board of Trustees of the New York and Brooklyn Bridge. Communication to the Board of Aldermen of New York by the President of the Trustees of the New York and Brooklyn Bridge, Made February 3, 1876. Brooklyn: Eagle Print, 1876. 19pp.

Documents Printed in Pursuance of the Order of the Board of Trustees, July 12, 1877. Brooklyn, 1877.

Hill, Albert, C.E. An Analysis of the Specifications for Steel Cable Wire for the East River Suspension Bridge. New-York, 1877. 17pp.

New York City, Board of Trustees of the New York and Brooklyn Bridge. Report of the Chief Engineer of the New

THE ROEBLINGS

York and Brooklyn Bridge, January 1, 1877. Brooklyn: Eagle Print, 1877. 14pp.

Communication from the Chief Engineer, W. A. Roebling, in Regard to the Method of Steam Transit over the East River Bridge, Made to the Board of Trustees, March 4, 1876. Brooklyn, 1878. 43pp.

Testimony Taken by the Committee of the Assembly, in Relation to the New York and Brooklyn Bridge, Pursuant to Resolution Passed February 5, 1879. Albany: C. V. Benthysen & Sons, 1879. 176pp.

Farrington, E. F. Concise Description of the East River Bridge, with Full Details of the Construction. New York: C. D. Wynkoop, printer, 1881. 62pp.

New York City, Board of Trustees of the New York and Brooklyn Bridge. Report of the Chief Engineer on the Strength of the Cables and Suspended Superstructure of the Bridge, Made to the Board of Trustees January 9, 1882. Brooklyn: Eagle Book and Job Printing Department, 1882. 12pp.

Green, S. W. A Complete History of the New York and Brooklyn Bridge from its Conception in 1866 to its Completion in 1883, with Sketches of the Lives of J. A. Roebling, W. A. Roebling, H. C. Murphy.

Barnes, Alfred Cutler. The New York and Brooklyn Bridge. Brooklyn, 1883. 116pp., illus.

J. S. T. Stranahan, W. C. Kingsley, S. Low. New York: S. W. Green's Sons, 1883. 96pp.

Report of the Special Committee of the Common Council of the City of Brooklyn upon the Celebration of the Opening of the New York and Brooklyn Bridge. Brooklyn, 1883. 40pp.

New York City, Board of Trustees of the New York and Brooklyn Bridge. Opening Ceremonies of New York and

THE FRUITFUL YEARS, 1865-1883

Brooklyn Bridge, May 24, 1883. Brooklyn: Eagle Job Printing Department, 1883. 122pp.

Hewitt, Abram Stevens. Address on the Opening of the New York and Brooklyn Bridge, May 24, 1883. New York: I. Polhemus, 1883. 26pp.

Conant, W. C. A History of the Bridge (reprinted from *Harper's Weekly*). New York: Harper and Brothers, 1883. No. 331 of *Harper's Franklin Square Library*.

Schuyler, Montgomery. The Bridge as a Monument (reprinted from *Harper's Weekly*). New York: Harper and Brothers, 1883. No. 331 of *Harper's Franklin Square Library*.

Our Four Big Bridges, a Critical Study of the Aesthetic and Scientific Qualities of the East River Bridge at New York City. *Architectural Record*, March 1929.

New York City, Board of Trustees of the New York and Brooklyn Bridge. Report of the Chief Engineer and Superintendent of the New York and Brooklyn Bridge, June 1, 1884. Brooklyn: Eagle Book and Job Printing Department, 1884. 12pp., 4 charts.

CHAPTER XIV

LONG RETIREMENT BUT NO IDLE DAYS

Second Marriage—Personal Characteristics—Pursuits and Hobbies, 1884-1926

SUBSEQUENT to the completion of the Brooklyn Bridge and its opening for traffic, Colonel and Mrs. Roebling went to Troy, New York, where they established a temporary home and lived quietly for four years, 1884-1888. This period coincided with the student career of their only son, John A. Roebling, 2nd, at the Rensselaer Polytechnic Institute, from which he was graduated in 1888. All then went to Trenton to live. A commodious mansion after the Tudor style of architecture, surrounded by ample grounds, was erected and occupied in 1892, and even today is recognized as the finest house in Trenton. Here the Colonel continued to live until his death in 1926.

His health shattered by his arduous labors, the Colonel henceforth was incapacitated for future professional activities and was compelled to live the remainder of his life in semi-retirement. From the hour of his first breakdown, throughout the rest of his life, there was not a day when his shattered nerves were not in pain, sometimes slight, sometimes severe. Although physically a wreck of his former self, his brain was as acute and active as ever. He continued to be deeply interested in the affairs of the Roebling Company to the end of his life, and his advice and experiences were always at the disposal of his brothers when knotty problems of policy and administration had to be solved.

LONG RETIREMENT BUT NO IDLE DAYS

From time to time, as he felt able to do so, he would go to the mill and thus kept in close touch with business affairs. He delighted to chat familiarly about old times with the elder employees, some of whom had worked in the mills nearly as long as he had.

At one time when the Trenton Chamber of Commerce gave a big dinner in the Armory in honor of the men and women of the city, who, for a period of twenty-five years or longer, had continued in the employ of one and the same concern or proprietor, the Colonel, who was present with a large group from the Roebling Company who had qualified for the honor, was selected among all those present to be the recipient of the Testimonial Loving Cup awarded to the person who had served longest, he having then been associated with the Roeblings for over seventy years.

COLONEL ROEBLING A LOYAL CITIZEN OF TRENTON

Colonel Roebling never held any political office, though he served several times as a presidential elector, representing the Republican party in the State of New Jersey. He took a quiet interest in the affairs of the city and held directorships in one or two local corporations. He was ever a loyal citizen of Trenton and expressed his full confidence in its financial stability and commercial future. He was a large buyer of its municipal bonds. On one occasion, after he had acquired a substantial block, the question as to the legality of the issue was disputed. The Colonel expressed no apprehension over the matter, but merely observed that he felt he could depend upon the city's honor to refund the amount to him if the issue should finally be declared illegal.

He was a liberal contributor to local charities and institutions, and from time to time made gifts to the Trenton Public

THE ROEBLINGS

Library of valuable technical books, as did also his son. He also gave a fine library to the town of "Roebbling" and built the club house for the stadium at Trenton. Though he objected to "drives," as a method of raising money, he could generally be persuaded to do his full share in these popular efforts. Like all the Roebblings, he shunned publicity in his giving and his known benefactions were probably far exceeded by those made in private. A pitiful tale of distress would always enlist his sympathy, and, while the probabilities are that he was often deceived, the consciousness of this fact never rendered him less sympathetic to future appeals of a similar sort. Particularly was his ready interest enlisted in the case of the old-time Roebbling employees, for whom he felt a real comradeship born of the intimacy of early days.

THE COLONEL'S PURSUITS AND HOBBIES

Although the Colonel had been compelled to retire from active participation in affairs in his forty-seventh year, he still had over forty years yet to live, and during this period he was never idle. He found plenty of subjects to occupy his busy brain during those periods when he was not suffering acutely and could be up and about. Of no one could it be more truthfully said that "his mind to him a kingdom was." He read constantly, for his eyesight was always excellent, all sorts of books, grave and gay, ponderous and witty. His literary tastes were catholic; theology and metaphysics, fiction and history, physics and geography—everything interested him. On the ample shelves of his library were volumes ranging from the stories of O. Henry, which he greatly enjoyed reading, to the latest books on scientific subjects, such as Einstein's *Theory of Relativity*.

When he was not busy rearranging his collection of minerals,

LONG RETIREMENT BUT NO IDLE DAYS

he commonly had a book in his hand. Then he did a great deal of writing. He seldom employed an amanuensis but wrote everything in his own hand. For a man of his years his penmanship was remarkable, almost like copy-plate. When he was eighty-seven years old, Senator Robert B. Cummins, vice-

1912 next State
Dec 25/24
John A. Roeblings Louis Co
Trenton

The enclosed money order for \$3.00
came in my personal mail - It is
probably for the business. if not, it may
be for my son

W A Roebling

*A Specimen of the Octogenarian Colonel Washington A. Roebling's
Handwriting*

president pro tem. of the United States Senate, who was the official recipient of the certificate of votes of the Electoral College, declared of Colonel Roebling's signature that "It was the finest in the College, dignified in its simplicity and written without a tremor or a blot. It was," he said, "a specimen of penmanship rarely equalled in these days."

Colonel Roebling liked to set down in written form, and presumably for his own satisfaction, reminiscences of his youth and manhood. Some specimens of these have happily been preserved and are incorporated in this book.

The favorite pastime of his later years was the working out of picture-puzzles. The ones he used were not to be found in the shops, but were made especially for him. They were cut from large photographs or reproductions of paintings and

THE ROEBLINGS

some of them were composed of more than twelve hundred pieces. Speaking of the matter one day he said: "I have solved more than five hundred of them and find working on picture-puzzles a lighter and more beneficial diversion than reading, card-playing or mah jong." When he had finished with them they were given away to friends, hospitals or other institutions.

HIS COLLECTION OF MINERALS

Always from a youth interested in minerals, he made himself an expert in mineralogy, and was universally recognized as having few superiors in that branch of knowledge. His own collection of specimens, numbering some 15,000 pieces, was regarded as one of the most valuable private collections in this country. His correspondence with those who shared this interest with him was of a world-wide character. He was continually adding to his collection and replacing less interesting specimens by better ones. He was always glad to exhibit his minerals to those who expressed an interest in the subject and would be at great pains to explain their significance to intelligent auditors. After his death his son John gave the collection to the Smithsonian Institution at Washington, providing an endowment of \$150,000 for its upkeep and replenishing.

Colonel Roebling was a fellow of the Mineralogical Society of America and gave \$44,000 as an endowment fund to insure the publication of the society's *Journal*. He was also an honorary member of the Mineralogical Club of New York.

Nearly twenty years ago, a visitor interested in the subject thus recorded his impressions of Colonel Roebling's collection of minerals:

"The cabinets and cases containing these treasures extend all the way about the walls of his study, which is a room as

LONG RETIREMENT BUT NO IDLE DAYS

large as the entire first floor of a dwelling of moderate size. It is asserted by expert mineralogists that this collection contains all but twelve of the minerals ever discovered in the world, and the missing ones are not now attainable at any price. When Colonel Roebing exhibits his collection to a visitor for the first time, he usually asks, 'Is there any precious stone or mineral of any kind that you have never seen and that you would like to see?' This question is asked after the collection has been examined and it has never been answered. Every observer of this superb collection, when he is interrogated, pauses to think and fails to recall anything that he has not seen here, and, while the observer thus hesitates, Colonel Roebing adds with quiet satisfaction, 'That question has not yet been answered by anyone.' "

The following account of the Roebing collection taken from *The Scientific Monthly*, Vol. 25, pp. 318-20, October 1927, will be found of interest to some readers. The article contains a description of the rarest specimens:

"There is probably not a dealer or collector of importance in the country that has not in his files one or more letters written in the fine, almost womanly hand for which the Colonel was noted. He sought not merely the beautifully developed specimens but those that were rare—indeed his aim was to secure a representative of every known mineral, however insignificant and uninteresting in appearance it may have been.

"While Colonel Roebing was not himself a man of research, he fully appreciated the work of those that were, and his choicest specimens were always accessible to authentic workers. Many mineralogists were frequent beneficiaries from his willingness to help through loan of specimens or by direct gift. With the National Museum he had been for years on particularly friendly terms of cooperation, a fact that doubtless

THE ROEBLINGS

was of influence in deciding the final disposition of his collection. The specimens were never catalogued, but were completely labelled in his own hand, often with amusing annotations and personal reflections. But about a dozen of the well defined species are wanting, and many old and obscure varieties may be found that are lacking in other collections—even the humblest having been secured wherever possible. It is in its completeness that its scientific value lies. Some of the more notable of the specimens have, since his death, received attention in the columns of the newspapers, but the matter will bear repetition here.

“Apatite: An extraordinary deep, rich purple crystal from Auburn, Maine, measuring 38x43 mm in the horizontal direction and 30 mm in the vertical direction, and weighing slightly over 100 grams. So unusual is this crystal in respect to size, color and crystal development that it was deemed worthy of description by W. E. Ford in the *American Journal of Science* for September, 1917.

“Beryl: A considerable number of examples representing many varieties and localities. Three from Brazil are especially fine; one weighing about a kilogram, of a light greenish yellow color with sharp hexagonal crystal boundaries, clear and flawless; one blue-green of about the same weight; and one light blue, with very good crystallographic development of the pyramid. The alkali beryls from Madagascar and California are also represented.

“Chrysoberyl: Two fine trillings, uncut. Have the form of a six-rayed star, are sharp in their crystal development and of a light green color. The largest is about 74 mm in diameter. There are also representatives of the variety alexandrite, one cut gem from Ceylon weighing 16.7 carats, and two uncut crystals from the Urals.

LONG RETIREMENT BUT NO IDLE DAYS

“Diamond: Represented by a remarkably well developed black crystal in the form of a perfect cube some 15 mm in diameter, with dodecahedral and octahedral forms on its corners and edges. Weight 64 carats. There is also the series of ten from Pike County, Arkansas.

“Euclase: A large light greenish-yellow fragment, showing some crystal faces, clear and flawless throughout, weighing 128 grams, from Brazil—a unique piece; also a light blue cut stone of fine quality, weighing nearly 4 carats.

“Kunzite: Represented by a flat crystal some 30 cm in length, 7 cm in width and 2 cm in thickness, as well as several smaller forms.

“Malachite: A beautiful large botryoidal mass some 15x30 cm in diameter is interesting for bearing the label, ‘Brought from Russia about 1874 by the Grand Duke Alexis and given by him to Henry A. Ward, of Rochester, for a mounted buffalo head.’

“Opal: The opal was evidently a favorite with Colonel Roeb-ling and the mineral is represented by a score or more pieces of all weights. The so-called black opal alone is represented by four fine specimens, one of which is the monster piece 10.5 x7.5x5.5 cm found in 1917, still uncut and weighing 2,665 carats or 18.6 avoirdupois ounces.

“Peridot: A fine clear-cut stone some 50x47x16 mm, weighing 310 carats, from Isle of St. John, in the Red Sea.

“Phenacite: There are several very fine examples of this mineral from Brazil, one large single crystal being 58 mm in diameter.

“Roeb-lingite: This mineral was named in honor of Colonel Roeb-ling. It is very unusual in composition, being the only mineral known to contain any sulphite. It always occurs massive and has been found only at Franklin Furnace, New Jersey.

THE ROEBLINGS

“Topaz: This mineral is well represented both in the cut (gem) and the crystal forms. Three amber-colored, long, prismatic crystals, terminated by pyramids, the longest measuring 20 cm, are from Brazil. There is also a fine group of the Siberian blue topazes and one cut stone weighing 397.9 carats and measuring 39x36x33 mm, a beautiful cut stone of a rich wine-yellow color weighing 93.6 carats and measuring 34x31x15 mm; and a cleavage cross-section of nearly colorless crystal from Brazil, weighing 45 pounds.

“Tourmaline: Of particular merit is a group of two large pink Mesa Grandes tourmalines perched on a base of quartz crystals. It is stated to be one of the finest and best that California has produced. There are also isolated crystals and cross-sections, showing zonal coloring, from California, Madagascar and other localities.

“Many others of the minerals while less showy are exceptionally fine. There are, for instance, good crystals of delafosite, an oxide of copper and iron; a perfect crystal of paramelaconite; an exceptionally fine connellite; one of the few known crystals of jeremejevite; a fine group of magnesioferrite crystals from Vesuvius; native crystals of antimony, and many others. The collection of Langban minerals, perhaps the greatest mineral locality in the world for unique minerals, is said to be unrivalled in America.”

The Smithsonian Institution has recently completed an index in longhand of Colonel Washington A. Roebling's collection of minerals. There are 6,600 different minerals and the entire collection includes approximately 16,000 specimens. The addition of the Roebling collection to the holdings of the Institution has resulted, in the opinion of the curator, in making the Institution's collection of minerals the finest in the world.

The Colonel loved flowers, a taste he shared with his broth-

LONG RETIREMENT BUT NO IDLE DAYS

ers, and he had a large conservatory on his place where he cultivated rare specimens, though he never developed this hobby to the extent that his brother Charles did.

DEATH OF MRS. ROEBLING AND HIS SECOND MARRIAGE

On February 28, 1903, Mrs. Roebling, whose health had been failing for some years, died, and the Colonel was thus left entirely alone, as in the meanwhile his son had married and was living elsewhere.

The death of his faithful wife, his helpmeet and companion for nearly forty years, was a great blow to him and left him inconsolable in his solitary state. The next five years were probably the most miserable in his life. All alone in his big house, attended only by hired servants, with no kith or kin to minister to him or to afford him companionship in his home, his plight was a pitiful one. Of course, there were his brothers and the members of their families who were ever solicitous for his welfare and eager to do all they could to alleviate his lonely state. There were also many warm friends who were frequent in their visits and were always pleased to have him share the hospitality of their circle. But the Colonel was never much of a hand for indulging in social diversions and he seldom left his home, although when he felt well enough he was always glad to welcome friendly callers. It was therefore with great satisfaction that his friends received the announcement of his second marriage, especially as his choice proved in every respect such a fitting one.

THE SECOND MRS. ROEBLING

On April 21, 1908, Colonel Roebling married for his second wife, Mrs. Cornelia Witsell Farrow of Charleston, South Carolina. She proved an admirable wife and mistress for his home, and her devotion, tact, and cheerfulness were elements

THE ROEBLINGS

instrumental in bringing a fresh interest into his life, and helping him to take a less gloomy view of things. Moreover, as a young and gracious hostess, Mrs. Roebling soon acquired her own group of friends, thus supplementing and increasing the Colonel's former circle.

In the presence of these brighter influences and surroundings the Colonel became at times almost jovial. His general health improved and when he began to feel better there came with the change a period of serenity to which he had long been a stranger. Though the Colonel never objected to his wife's leaving him for the purpose of paying visits to her family and friends, she seldom did so and then only for a brief period. As the Colonel himself was averse to leaving his home, even to take brief vacations in the summer time, his wife commonly remained with him and bore him company, when every one else who could do so had forsaken the hot, dirty city for the delights of the seashore or the mountains. He would often beg her to leave him and go away with some friends, but she could never be persuaded to do so, except for a day or so at a time. She well knew he would be inconsolable without her and felt it was her wifely duty as her pleasure to remain with him, even at the cost of her own discomfort and the impairment of her health, which at times occasioned both her husband and her friends no little concern.

As an evidence of the good understanding which existed between the two the following little incident may be related.

One day Mrs. Roebling, the Colonel being absent from home at the time, received a call from the rector, who had been deputized by the vestry to make an appointment with the Colonel to meet a committee from that body with a view to securing a substantial contribution from him toward a fund that was being raised for the renovation of the church, or some



*The Second Mrs. Washington A. Roebling,
née Cornelia Witsell*



*The Residence of Colonel Washington A. Roebling, 191 West State Street,
Trenton, where He Lived from 1892 until His Death in 1926*

LONG RETIREMENT BUT NO IDLE DAYS

like purpose. The rector stated his errand. Mrs. Roebling promptly replied: "Oh, it's unnecessary to bother the Colonel about that. How much do you want him to give?" The rector mentioned a substantial sum, running into four figures. Mrs. Roebling promptly replied, "I'll give one half of that sum myself and pledge the Colonel for the other half." At that moment the Colonel himself made his appearance and his wife told him what she had done. "Oh, that's all right," said the Colonel, "when I saw Mr. So-and-so here I suspected it was just another 'drive'." "Yes," replied the rector, "it is another drive and I congratulate Mrs. Roebling and indeed both of you, on the mutual confidence which prevails between you. This is the first time I have known a wife to pledge a sum like that for her husband without having previously consulted him."

COLONEL ROEBLING REASSUMES PRESIDENCY OF THE COMPANY, 1921

In 1921 when Colonel Roebling was in the eighty-fourth year of his age, having survived his two brothers, the tragic death of his nephew Karl G. Roebling, then the president of the Roebling Company, rendered it imperative for him to assume the headship of affairs. It was a heavy burden to take up for one of his years, but the veteran rose courageously to the occasion and performed all the duties of his office with that grim determination which always animated him in every emergency of his life. Certain important changes in the plant had been under consideration for some time and were now carried out under the Colonel's personal supervision. He changed the motive power of the main plant from steam to electric, and developed an entirely new department for the electrolytic galvanizing of wire. He took and completed the contract for

THE ROEBLINGS

the Bear Mountain Bridge over the Hudson River, and other lesser works. His executive handling of the business was along the lines of the best modern methods. He did not interfere with routine details but left adequate initiative and responsibility to his subordinates. Where important decisions were called for he made them quickly and, as the general results proved, correctly.

SOME REFLECTIONS ON LIFE

In an interview which he gave about this time, the Colonel when he was asked how he was able at his age to do his job, replied: "Because it's all in my head. Sixty years I've known it all, and it's all there yet. It's my job to carry the responsibility and you can't desert your job. You can't slink out of life or out of the work life lays on you. I haven't any new plans, but I've lived through hard times before and I can do it again. Anyway, folks think I do a lot more than I do. My appetite is pretty good. I still eat plenty of pie, but I haven't eaten a raw apple in thirty-five years. I manage to keep busy the regular business day, 9 to 5. When I'm not working I have my home, the society of my wife and my dog, 'Billy Sunday.' Then I read a good deal, especially novels. They are a mild form of intoxication, but they rest me. There were ten years of my life, from my forties to fifties, when I hardly ever stirred out of my room. There was a time when I thought I'd be blind."

"How would you advise others to live as long as you have?" was asked.

"I would not advise them to do it. I'd be glad to go anytime, but you've got to take the days that are sent you. I don't know why I have lived so long. I've buried fifty doctors."

Asked how he kept so young and fit, he replied: "I don't keep young and fit. I can't hear out of this ear [touching the

LONG RETIREMENT BUT NO IDLE DAYS

right] and I can't see out of this eye [left]; my teeth aren't right. My chest hurts me when I talk. It takes me ten minutes to go up and down stairs. If I only felt fit I could do anything, but I don't even for a few minutes at a time."

"There is just one rule," he added, "for keeping well as long as you live and that's Common Sense. There is a monitor here [tapping his forehead] that tells you how to use it. But people don't obey. I didn't. Lack of common sense is responsible for everything that ailed me. We should have common sense in eating, drinking, working, playing, and choosing a wife. A good wife is a great help in living many years. I'm not worrying about anything. I never borrow trouble about what may happen tomorrow."

Finally as a parting shot: "You can go home and say you have seen a man who has never set foot in an automobile."

The Colonel was an easy man to interview, but he was provoked if anything he said was not accurately reported. He was, himself, a great stickler for accuracy in statements. When his brother Charles died in 1918, and one of the metropolitan newspapers gave him the credit for building the Brooklyn Bridge, the Colonel addressed a letter of protest to the editor. It began thus: "Whenever a Roebling dies the newspapers assume that the deceased was the Roebling responsible for the building of the Brooklyn Bridge." He then proceeded to explain that Charles was only twenty years of age when the bridge was begun and had yet to complete his training as an engineer. The editor published the letter and was profuse in his apologies for the mistake made.

CHARACTERISTICS AND ODDITIES

On almost any fine afternoon the Colonel could be seen slowly sauntering along West State Street in the vicinity of

THE ROEBLINGS

his home accompanied by his Airedale, "Billy Sunday." He often sat down on his neighbors' doorsteps to rest himself. If he saw anyone he knew approaching and felt disinclined for conversation at the moment he would turn into the nearest gateway and thus avoid a meeting. Everybody knew him and none of his acquaintances took offence at this palpable subterfuge.

"Billy Sunday" was so named because he joined the household on the same day that the popular evangelist came to town to hold a revival.

"Billy" was a faithful companion and devoted to his master, though he once wandered away and was not seen for a month. When he returned he was in a shocking condition, gaunt, unkempt and with a hangdog look. The Colonel was convinced that "Billy" never went away of his own accord, but was kidnapped by some one and finally managed to escape.

"Billy" was the only dog who enjoyed a free pass on the Trenton trolley line. He invariably accompanied his master on his street-car rides to the mill, for the Colonel would never enter an automobile. He said the jar affected his nerves.

Many amusing stories are told of the Colonel's oddities and crotchets. He would never wear gloves, even in the coldest weather; his wife said "he didn't own a pair." Sometimes at the homes of friends upon whom he was paying a casual visit, if he felt tired he would, without asking permission or making any apology, proceed to make himself comfortable by lying down on an available sofa and go fast asleep or seem to do so.

When he was disinclined to talk with visitors, as he often was, probably not feeling up to the effort at the moment, he made no pretense of his disinclination but simply closed up like a clam. He intended no discourtesy and no one took offense, for his ways were well known.

LONG RETIREMENT BUT NO IDLE DAYS

“Oh, these women, these women, they will be the death of me,” he declared, as a young lady, a great friend of his wife’s, was inadvertently ushered into the room where he was sitting.

“Why, what’s the matter with the women, Colonel?” said the visitor. “Oh, they just talk and talk and talk. Three of them have been here this afternoon and I thought their chatter would about finish me.”

“Well, don’t distress yourself about me,” she retorted. “I’ve got a bad throat and it hurts me to talk.” “Thank God!” was the fervent reply.

The Colonel disliked going to the barber and when his wife thought his hair and beard needed trimming, the barber would be sent for to come to the house. One day about the period when his services would seem to be required, and his wife had told her husband that she was going to send for the barber, what was her astonishment on returning home to find the Colonel seated in a chair with a towel about his neck, and a lady, an intimate friend of the family, scissors in hand, shearing the Colonel’s locks. There was a tableau. The Colonel looked up and in his laconic way dryly said, “saved fifty cents.”

The Colonel certainly had his religious views, but just what they were it was difficult to discover. Though he professed no special religious affiliations, and was not a regular attendant at church services, he respected the religious convictions of others and never said anything to disturb them in their beliefs. He was tolerant of all religions and was widely read in theological lore. He had a great admiration for St. Paul and often quoted him. His memory for scriptural passages was remarkable and he would note at once any misquotation. Job and Ecclesiastes were among his favorite books in the Bible. Even

THE ROEBLINGS

to the Apocrypha, so little known or read in these days, he was no stranger.

Probably he had evolved a working religion, or rather a practical philosophy of life, that was his own, though he never openly admitted it. Life, he often said, was a mystery to him and his only guiding star was the light of conscience.

COLONEL ROEBLING'S DEATH IN HIS EIGHTY-NINTH YEAR, 1926

It was an annual custom in the Roebling home on the Colonel's birthday for the members of the family and intimate friends to assemble and extend their good wishes and congratulations. On May 26, 1926, he observed his eighty-ninth birthday, but owing to his weak state, the occasion was confined to the presence of the members of his immediate family. From that time on he continued to fail, suffering from extreme weakness, rather than from any definite disease. Up to a few days before his death, officials of the Roebling Company frequently went to his house to consult him about important business matters which he settled with his customary decision. He thoroughly realized his critical condition, and shortly before his death remarked to relatives that about all of his physique which remained to serve him was his brain. He added, he was grateful for this much.

The end came peacefully on July 21 at 3:30 in the afternoon. At his bedside were his wife, his son John A. Roebling, 2nd, and Mrs. Roebling of Bernardsville, New Jersey, his grandson Siegfried Roebling, and Mr. and Mrs. John B. Farrow of Charleston, South Carolina, son and daughter-in-law of Mrs. Washington Roebling. The funeral services were held in the Roebling home, and the honorary bearers were from among the executives of the Roebling Company. The body was subsequently taken by a special train to Cold Spring on the Hud-

LONG RETIREMENT BUT NO IDLE DAYS

son, opposite West Point, where, according to his wishes, it was interred in the village cemetery beside the remains of his first wife, Emily Warren Roebling.

Who may doubt that Washington Augustus Roebling has been admitted to the select company of the "strong men," of whom Rudyard Kipling sings:

Who had done their work and held their peace
And had no fear to die. . . .

And that a place was made for him by his comrades, the "gentleman unafraid," at the banquet-board provided by the "Master of all good workmen"?

The author of this book feels that no further comment on his part, or attempted interpretation of Colonel Roebling's life and character, is required, but would rather appear to be a work of supererogation, if not an impertinence. He has striven to depict the man as he knew him, in the community where both lived, supplementing his own knowledge and impressions by the judgment of those who could claim a close friendship and intimacy with the man, to which honor he himself makes no claim.

In the city of Trenton Colonel Roebling was for years regarded as its leading citizen and all Trentonians are proud of his achievements and revere his memory. It is universally felt that his presence here lent distinction to the town, and that by his death it has sustained a loss which cannot be measured in words.

Perhaps after "an aeon or two" of that rest, for which his tired soul craved, he may be set to work anew at some celestial task, when

No one shall work for money,
And no one shall work for fame,
But each for the joy of the working. . . .

THE ROEBLINGS

COLONEL ROEBLING'S ESTATE

Colonel Roebling's estate, as determined by the government for tax assessment purposes, was placed at some \$29,000,000. Of his residuary estate he left one-third to his widow and two-thirds to his son.

Legacies were left to his daughter-in-law, Mrs. John A. Roebling, his two grandsons Siegfried and Donald Roebling, and to his stepson John B. Farrow. To his son John he gave his minerals, personal effects, books, pictures and household furniture, and also his shares in the Roebling Company, except those previously given to his wife. The Roebling mansion was already the property of his grandson Siegfried, he having inherited it from his grandmother, Colonel Roebling's first wife. As a token of his appreciation of their services to the Roebling Company certain of the executives were remembered by shares in the corporation. The sum of \$5,000 was also distributed among the servants of his household. Bequests to institutions included \$50,000 to the Rensselaer Polytechnic Institute at Troy, New York, and three Trenton hospitals.

CHAPTER XV

SOME "OBITER DICTA" OF AN OCTOGENARIAN INDUSTRIALIST

THERE are printed below, purposely isolated from their context, certain short passages, gleaned from the writings of Colonel Roebing, which would seem to be worth emphasizing, as proceeding from a virile thinker, well qualified by his attainments and long experience, to express his views on life and particularly his judgments upon the principles to be observed in the conduct of a great business enterprise. They may be regarded as aphorisms or reflections, not deliberately conceived and set down as such, but rather, and the more valuable on this account, as incidentally called forth by certain practical matters which the writer was considering at the moment.

As to promoters

Whenever a persistent promoter with a pull gets a footing in a business it spells disaster in the long run.

The need for personal supervision

No business can flourish unless it is to a large extent under one's own supervision, and there is a limit even to that.

Municipal contracts

To work for a municipality is an endless fight and vexation of spirit.

Owning a town

The man who owns a town, often wishes he had never been born.

THE ROEBLINGS

The time for expansion

After the war frenzy a few years of quiet sedate business seem to be coming, even a year or two of hard times, when money-making almost stops and no one has the heart to advocate new extensions or new enterprises, whereas that is just the time to inaugurate them.

Profit-sharing

The profit-sharing system for employees generally, has always failed. The whole system is impossible; people want to share profits, never losses. Most working men don't care for it. They want steady employment the year round. Men have been in our employ for 40 or 50 years.

Prohibition and efficiency

I have not noted any greater efficiency in workers since the advent of prohibition.

New projects

No project ever gets firmly established without halts and then calls for additional capital.

The pig-headed workman

The pig-headed workman always acts contrary to his real interest, because every improvement increases the output and improves the quality, and thus gives him more work in the end.

Sticking to one's legitimate business

I have always thought that our own legitimate business, which is thoroughly understood, afforded every avenue of expansion that the future might offer, and I still think so.

How judgment goes astray

The best judgment often goes astray because we are

SOME "OBITER DICTA"

prompted too much by our greed or influenced by the fluttering moth of more orders in the future.

The owner's bugbear

The owner has one bugbear always confronting him, and that is, he must keep the factory running as nearly full as possible, otherwise the vast number of outside and overhead expenses eat him up.

"Yes" or "No" important words

Sometimes the executives of a well organized business seem to do little active work, but they are not unimportant. There must be someone at hand to say, "yes," or "no," and it often makes a great difference which word they use.

The necessity to strike out on new lines

As profits, owing to competition, are soon reduced, it is necessary to go into some new line of business, because it is only in the first few years that large profits are possible, but it does not always follow that a new departure is a success.

Buying ideas

Sometimes it is much cheaper to buy what you want than to waste thousands in experimenting.

The test of courage

The hardest test comes when it is imperative to reduce wages in hard times. It requires courage then to face a band of infuriated men.

The excitement of a paying business

An active, prosperous, paying business is a source of great excitement. Almost daily new propositions come up to be considered on their merits. In the course of years the judgment becomes cultivated.

THE ROEBLINGS

Taking risks in slack times

There are always periods in the life of a company when work is very slack and in order to keep the organization together, great risks are run to get orders.

Foresight and experiment

Not everything can be thought out in advance, usually something has to be perfected by intelligent experiment.

The training of a successor

The time inevitably arises when it is necessary to train someone else to take your place.

A reputation for infallibility

It is a great thing to have a man at the manufacturing head in whose infallibility every subordinate has the most profound confidence.

How hearts are hardened

Life's crucible hardens many a heart, and one has to make allowances in judging character.

A man's best asset

After all, vitality, supported by good judgment, is the best asset.

Union labor

With union management the walking delegate becomes the real master; he dictates the hours of labor, makes the wages, hires and discharges men, stops piece-work and reduces everything to the lowest efficiency. The real owner becomes a mere clerk, allowed to look after orders and finances. His reward is a mere pittance compared to the wages of the men. All progress stops.

SOME "OBITER DICTA"

Inherited qualities

It might be argued if a man inherits everything he deserves no credit for it. That would be so in a life of universal monotony, but with each generation in turn totally different conditions and environments arise. These have to be met by the new individual who must develop his powers to adapt himself to them; to overcome them and use them as his tools.

The need for forgetting

I am still busy trying to forget the mass of heterogeneous knowledge that I could only memorize, not really digest.

High-pressure constitutions

Persons endowed with a high-pressure constitution have their destiny marked out for them. It forces them to work hard to the end of their lives. There is no rest for them.

Brothers in business

When brothers are together in business the proper amenities are often neglected.

Jobbers control profits

Every new branch of business is always a pet for several years, until the novelty wears off and initial profits have been reduced by competition, and by the unfortunate fact that jobbers really control the profits.

Success in business

The secret of success in many a business consists in the ability to weather hard times, in keeping your business intact, and your workmen employed, even at a small loss.

Cutting losses

It is easy to jump into a new speculation and so difficult to withdraw without great loss, such as the faculty of cutting

THE ROEBLINGS

a loss, which is seldom exercised at the right time, until you are an old man, and then it is too late.

Animosities

Too often antagonism ends in life-long animosity.

Qualifications for greatness

History teaches us that no man can be great unless a certain amount of vanity and esteem enters into his disposition.

Heredity and chance

I am a great believer in heredity. Fully nine-tenths of our qualities are the result of direct inheritance; the other tenth comes from experience, from contact with the daily business surroundings, usually forced upon you by circumstances and also by chance. Chance plays a large part in our progress through life.

Bowing to the inevitable

With advancing years the mind realizes that you cannot control everything and must bow to the inevitable.

A good wife

A good wife is a great help in living many years.

The rule for keeping well

There's just one rule for keeping well as long as you live, and that's Common Sense. But people don't obey. I didn't. Lack of Common Sense is responsible for everything that ailed me.

Edison's questionnaire

He does that just for fun, I guess. I don't see what else. They are not hard questions, mere matters of memory. If he asked hard questions he could get nobody to work in his plant.

SOME "OBITER DICTA"

Slinking out of life

You can't desert your job. You can't slink out of life or the work that life lays on you.

Memories retain the good

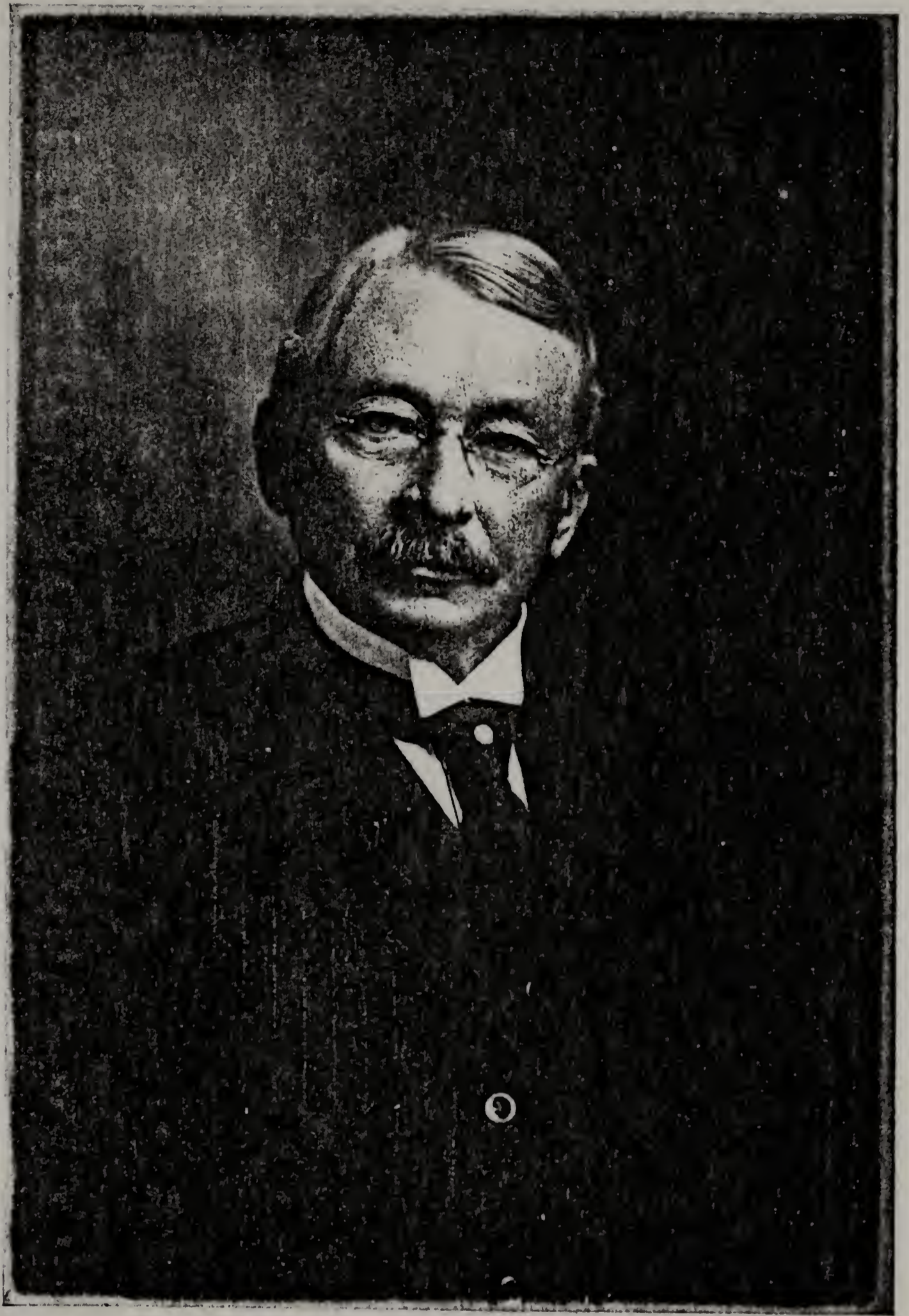
As time goes by, our memories retain only the good; the other things fade away.

The mystery of death

What death really means I do not understand. We enter life without knowing it, and leave it unconscious. Cut off thus at either end, all we can do is to obey the dictates of the infallible conscience with which we are endowed by nature—but who succeeds in doing that?

PART III

FERDINAND WILLIAM, CHARLES GUSTAVUS AND
THE THIRD GENERATION



Ferdinand William Roebling, Sr., Secretary-Treasurer of John A. Roebling's Sons Company, 1876-1916

CHAPTER XVI

FERDINAND WILLIAM ROEBLING

Financier, Super-Salesman, and Politician, 1842-1917

SHORTLY after Ferdinand's death, his brother Washington wrote a short memoir of him, which was adopted as a minute by the Roebling corporation, and is printed at the close of this chapter, as a valuable estimate of his character and achievements. The memoir is written in the Colonel's inimitable style and bears the impress of the candor and detachment which characterized him when referring to the members of his family, as indeed they also marked his writings on every subject. Significant comments upon the conditions which furnished the opportunity for Ferdinand's talents, as displayed in the management of the company's affairs, run through the paper.

Also in a comprehensive sketch of the development of the business, printed subsequently in this book, likewise written by Colonel Roebling, following the death of his brother Charles G. Roebling, and largely concerned with Charles' achievements as an engineer and builder, will be found many references to the important part played by Ferdinand. This narrative, read in conjunction with the present one, will furnish a clear understanding of the circumstances relating to the conduct of a great enterprise and its successful progress over a long series of years, due to the combined efforts of two talented brothers, each working in his own separate department and ably supplementing each other in the attainment of a common purpose.

THE ROEBLINGS

The main facts concerning Ferdinand Roebling's life can be briefly summarized.

The second son of John A. Roebling and Johanna Herting Roebling, Ferdinand was born in Saxonburg, Pennsylvania, February 27, 1842. Thus when the family removed to Trenton in 1849 he was about seven years of age. He received his preliminary education in the old Trenton Academy where so many of the sons of prominent Trenton families then attended school. He went later to the Philadelphia Polytechnic Institute, specializing in the study of chemistry.

LETTERS WRITTEN TO CHARLES SWAN, 1858

In the autumn of 1858, Ferdinand was entered in the science course in the Columbian College, now the George Washington University, Washington, D.C. During this period he wrote several letters to Mr. Swan. They are couched in boyish language and have to do mainly with observations relating to his life in that city and requests for supplies to be sent from home. Even then he appears to have had a shrewd eye open for business opportunities, and had evidently made some sales of wire rope on his own initiative. Some of the letters bear no date, but all obviously were written between the months of September and December, 1858.

Some scattering excerpts from these letters may be given. The youth was evidently alive to the opportunities which his stay in the capital city afforded. He had listened to some political debates and writes to Swan about them. "You ought to have been down here last Thursday to hear Housten speak; he gave it to Iverson the tallest kind." He declares that he prefers Trenton to Washington. "Washington is not so nice a looking city as Trenton. The streets are wide but not half built-up, and nearly all the houses are old frame buildings and only Irish and niggers live in them." He had been in-

FERDINAND WILLIAM ROEBLING

specting the Navy Yard and admires very much what he has seen. "I went down to the Navy Yard the other day and was quite astonished to see so much machinery. They have a steam-hammer there that you could not put in our rolling mill. Their machine shops are splendid. Everything could be put in a parlor and set to work without making any dirt." The family cow at home had died and the event evokes this comment: "I am sorry to know that the old cow is dead. Do you know what tune she died on? I hope you have made a compost of her remains; one made out of her ought to be worth at least twenty dollars." He complains about the cost of living in Washington and begs Swan to send him some money. "You might send me a draft [his commission on account of some wire rope which he had sold]. It costs a thundering lot to live here, for books and a lot of other things; a book which costs fifty cents in Trenton costs one-fifty here." He longs for pumpkin pies, but apparently finds it is unknown there. "You must not talk about pumpkin pies as it only makes my mouth water. If you were to see such a thing here you might think the world was coming to an end." He reports that owing to the opening session of Congress the college is to be closed for the day and that the students will probably hold high festival. "We have no recitations at the college next Monday because it is the first day that Congress opens. I guess most of the students will get drunk, although they have hardly got over their Thanksgiving spree. They are a pretty hard set, almost equal to those at Princeton." He has an eye for pretty girls and finds many in Washington. "If any one wants to see good-looking girls he ought to go down on the Avenue about four o'clock in the afternoon."

The nature of the boy and the sort of things which he deems worth commenting upon were evidently the same seventy years ago as they are today.

THE ROEBLINGS

FERDINAND ENTERS THE INDUSTRY, 1859

Following his graduation in 1859, Ferdinand entered his father's mill in the wire-rope department, working at first as secretary under the supervision of Charles Swan, the superintendent of that branch of the industry.

When the Civil War broke out, Ferdinand, now in his nineteenth year, was anxious to enlist, as his brother Washington had previously done, but the father was unwilling to be deprived of the services of both of his sons and refused to give his consent. Owing to the elder Roebling's long absences on his engineering projects, much responsibility was thrown upon the young man, and thus very early in life he was largely left to his own resources and compelled to make important decisions. Hence, after the death of his father in 1869, Ferdinand, with nearly ten years' experience in the business, was fully qualified to take a leading part.

Ferdinand was joined in 1871 by his younger brother, Charles, who had just graduated as an engineer. Henceforth, the brothers divided the responsibilities of the business between them, Ferdinand retaining the commercial, and Charles assuming the building and engineering. This combination continued unbroken with wonderful results for nearly fifty strenuous years.

The personal history of Ferdinand, as also of Charles, is found mainly in the records of the Roebling achievements, though of necessity Ferdinand cultivated more outside interests than his brother, and as the executive and mouthpiece of the company moved in wider circles and established more contacts with the outside world. As secretary and treasurer of the John A. Roebling's Sons Company, from its incorporation in 1876 up to the time of his death, he became, from time to time, officially associated with many corporations; several of these

FERDINAND WILLIAM ROEBLING

for purely protective reasons. Among some of the more important positions which he held were the following: director, Standard Fire Insurance Company; director, Trenton Hall and Building Association; treasurer and director, The New Jersey Wire Cloth Company; president and director, The Universal Paper Bag Company; director, Otis Elevator Company; director, The United Power and Transportation Company; president and director, Trenton Brass & Machine Company; director, Inter-State Railways Company; director, Public Service Corporation of New Jersey; director, National Copper Bank of New York; director, Mechanics & Metals Bank of New York; director, Mercer Automobile Company; director, Mechanics National Bank of Trenton; director and vice-president, Syracuse, Rochester and Eastern Railroad.

This formidable catalogue is inserted here merely to suggest a measure of the outside interests which claimed the attention of Mr. Roebbling. It is marvellous how he found the time to discharge the duties in connection with these numerous offices, but he seems to have done so.

Besides these business organizations he was actively associated with several local institutions. He was an original trustee and the first president of the board of the Trenton Free Public Library, with which he had been identified from its foundation in 1900, and for the promotion of which he was mainly responsible, giving largely of his time and money to its upbuilding.

He was an ardent member of the Trenton Country Club and served for a period as president, doing much for its material improvement and its financial stability. When the present City Hall was contemplated in 1909, Mr. Roebbling was appointed chairman of the building commission. He was several times chosen as delegate to Republican National Conventions and

THE ROEBLINGS

he heartily enjoyed these experiences. As showing the high repute in which he stood in the big financial world, he was selected as a director of the Equitable Life Assurance Society when it passed into the hands of Messrs. Cleveland, O'Brian, and Westinghouse as trustees.

Mr. Roebling was a great lover of hunting and fishing and a recognized expert in these sports. He was also a fine trap-shot. These were the main diversions which he allowed himself. He seldom took a prolonged vacation, a few days at a time were all he felt he could spare from his busy life for such indulgences. Like all the Roebblings, he was fond of flowers and cultivated them. In the latter years of his life he bought a farm of some three hundred acres in the vicinity of Trenton Junction, a short motor ride from his home, where he raised chickens and bred fancy cattle, and this gave him great pleasure, though it was of course, financially, a losing proposition and first and last absorbed a good deal of money.

HIS MARRIAGE AND CHILDREN

He married, March 14, 1867, Margaret G. Allison, daughter of Thomas S. Allison, Secretary of State of New Jersey, from 1851 to 1861.

Four children were born to the couple, two boys and two girls: Karl G. and Ferdinand W., Jr., Margaret, afterward Mrs. Frederick A. C. Perrine, and Augusta Henrietta, afterwards Mrs. William T. White, all of whom survived him.

It was a source of deep gratification to him that his two sons, Karl G. and Ferdinand W., Jr., both well qualified by their training and natural endowments, should have fulfilled his desires for them and have taken each his appropriate place in the Roebling Company; Karl, in his own department of finance and administration, and Ferdinand, as an engineer, working at first directly under his uncle Charles. Biographical



Mrs. Ferdinand W. Roebling, Sr.



Residence of Ferdinand W. Roebling, Sr., 222 West State Street, Trenton, Subsequently Altered and Now Occupied by His Son, Ferdinand W. Roebling, Jr.



The Present City Hall of Trenton, Completed in 1910, of Which Ferdinand W. Roebling Was Chairman of the Building Commission



The Trenton Free Public Library, Erected in 1902, of Which Ferdinand W. Roebling, Sr., Was a Benefactor and First President of the Board of Trustees

FERDINAND WILLIAM ROEBLING

sketches of the two sons will appear under the chapter, "The Third Generation and After."

His wife, to whom he was devotedly attached and with whom he had lived in perfect companionship for nearly fifty years, died October 2, 1914. He never recovered from the loss, though he found compensation in the affection of his children and the deep interest he took in his grandchildren, of whom there were nine living at the time of his death; a boy and two girls, children of Karl G. Roebling and his wife Blanche Estabrook Roebling; two boys, sons of Ferdinand W. Roebling, Jr., and his wife Ruth Metcalf Roebling; two girls, daughters of Margaret Roebling Perrine and her husband Frederick A. C. Perrine; and a boy and a girl, children of Augusta Henrietta Roebling and her husband William Townsend White.

He passed away in his seventy-fifth year after a brief illness, March 16, 1917, and was buried in Ewing Cemetery.

HIS BUSINESS CAREER

Of business executives in the industrial world, covering the period of his active career of nearly sixty years, from 1859 until his death in 1917, there were probably few or none in this country who have exhibited a greater measure of ability and energy than Ferdinand W. Roebling. A true son of his father in his enterprise and foresight, he played a leading part in the affairs of the Roebling Company, and it was largely due to his genius for management and his astute grasp of conditions in the business field that the phenomenal success of the industry was attained.

In contradistinction to his two brothers, Washington and Charles, who were rather engineers and producers than business men or financiers, Ferdinand was the keystone which sustained

THE ROEBLINGS

the structure, or, to change the metaphor, his was the driving power which served to make their efforts effective and profitable. If his two brothers were geniuses in their profession, Ferdinand in his less spectacular part was no less so on the commercial and financial sides. If his brothers were creators, Ferdinand was the man who, by his contacts with the business world and his knowledge of the prospective requirements in the industry, directed their efforts into appropriate channels.

A creator and producer must be guided aright in his endeavors or his work will go for naught. He must know what lines of effort it is profitable to undertake and, also, when the conditions have arisen which make a change necessary. Ferdinand was the eyes and ears of the company. It was his judgment, experience and foresight which pointed the way to successful accomplishment, and which likewise gave warning as to the need for abandoning old methods and materials and adopting new.

All manufacturing enterprises are more or less speculative, depending for their financial success largely upon the vigilance and judgment of the management. New methods are constantly being called for, styles are changing, competition becomes sharper and the vessel must be made to take a new course if loss and disaster are not to follow. The man at the rudder must be continually on the alert and take advantage of every favoring breeze. He must divine the approach of stormy weather and be quick to shorten sail when prudence advises. Mistakes are often costly, where they are not ruinous. Even the ablest are not immune to them, but he who makes the fewest and is able quickly to retrieve them is bound to win out as against his less sagacious rivals and competitors. It was in these ways that Ferdinand revealed the possession of his remarkable talents.

FERDINAND WILLIAM ROEBLING

To conduct and manage a business for fifty years full of changes and vicissitudes and to see it grow in one lifetime from small beginnings to a colossal magnitude, argues the possession by the responsible head of qualities creditable to his brains and character. When Ferdinand, after the death of his father in 1869, entered upon his responsibilities in their fullness, the company had a capital of about \$150,000, while, at his death some fifty years later, the book value of the plant was between forty and fifty million dollars. It is not of course, that the credit for this growth wholly belongs to Ferdinand, and he would have been the last to make such a claim, but certainly it was largely due to his sagacious management over all those years. His was the business policy that prevailed. Charles was occupied mainly with the engineering and producing ends, and in these departments he was as supreme as Ferdinand was in his. Charles, by training and temperament, stood aloof from contact with the business world. His problems were rather technical than commercial or financial, and on Ferdinand's shoulders therefore rested the burden of grappling with competitors, buying the raw material, making the prices and pushing the wares in the markets of the world. That much hackneyed phrase, "Captain of Industry," often used to designate the leaders in the manufacturing world, is not an appellation which he would have wished to claim for himself, though it was quite generally applied to him and seldom more significantly.

He was a recognized leader, and his judgments on business matters were universally regarded as sound and sensible. Thus it came about, that not only in the immediate circles of his own community and trade but in the larger world, his advice and cooperation were eagerly sought after. His personal enlistment in projects and enterprises, often of a widely diverse character,

THE ROEBLINGS

was regarded as a certificate of their value and sufficient assurance to the public of their soundness.

In local affairs, if "F. W." could be persuaded to take a part, the projectors deemed themselves fortunate and, contrariwise, if he opposed their schemes, they were commonly abandoned, or at least reframed on the lines he favored.

In political or civic matters which enlisted his interest he commonly dominated the groups with which he worked. His views were always positive and few cared to oppose him. Though a man of few words and a patient listener to the arguments of his collaborators, when he had once made up his mind and finally expressed himself, his decisions were irrevocable. If his judgments prevailed he threw himself into the cause with all the energy of his nature, if not, he washed his hands of the whole matter. He was accused of possessing a domineering spirit and of an unwillingness to compromise. The charge had some justification, though the motives which animated him were often misunderstood and misrepresented. It was not that he was indisposed to see the other side, or that he unduly depreciated the judgment and opinion of others, but rather, that, having thought the subject through for himself in all its ramifications, he had come to a conclusion which satisfied him, and was thus disinclined to indulge in further argument. As far as he was concerned the matter was settled and others interested could do as they liked, but without his assistance.

He never sought popularity, and was commonly thought to be indifferent to the opinions of his fellow citizens, but he was really a highly sensitive man, only so constituted that he was unable to ingratiate himself in the public favor by an even apparent condescension to their prejudices. When he was publicly criticized, as sometimes was the case, he commonly re-

FERDINAND WILLIAM ROEBLING

frained from offering any defense of his actions. These attacks undoubtedly hurt him at the time, but their sting was only temporary. His interests were too wide and varied to allow idle gossip or journalistic pin-pricks to embitter him permanently.

He had his cherished group of friends, who were devoted to him and fully appreciated the generous qualities of his character, obscured though they often were from the public knowledge by an apparent indifference to popular opinion. Above all, he had his family, and in the sheltered seclusion of his home he found abundant joy and solace to compensate him for whatever friction and unpleasantness his business and public life entailed. He was an affectionate and generous father and his children amply responded to the love and devotion which he lavished upon them. As a host in his own home and among those admitted to his friendship and intimacy he was seen at his best and in that genial atmosphere he graciously expanded as nowhere else.

Like all the Roeblings he was an indefatigable worker, who "scorned delights and lived laborious days." His inclinations and his duties served to bring him into close contact with a wide world of affairs, though they placed burdens upon him of a character that were often remote from his immediate business. To protect the Roebling Company's wide-flung interests he was compelled reluctantly to assume directorships in many enterprises which absorbed the time and energies which he would otherwise have devoted to his immediate concerns. But these experiences, on the other hand, afforded him a close insight into the trend of affairs in the general business and financial world, thus widening his vision and giving him a knowledge that he could not otherwise have attained, and which later proved helpful to him in arriving at correct decisions in his own special field of activity.

THE ROEBLINGS

A POLITICAL ARBITER IN LOCAL AFFAIRS

With all these burdens and responsibilities resting upon his shoulders it is marvellous how he found the time to give the attention he did to local affairs. For years he was the recognized arbiter of his political party in the city and county where he lived. Though he never held or sought an elective office, his influence was nevertheless of a dominant character. Politicians, petty and great, sought his advice and solicited his support. He was the real if unseen power that planned campaigns and dictated nominations. Nothing was done without his consent. In the wider affairs of the State and Nation his influence was acknowledged and felt, though his part was naturally more advisory than dominating.

The reasons for his excursions into the political sphere are difficult to discover. He had certainly no direct personal interests to serve or ambition for public office to gratify. Probably the incentive was the pure love of power for its own sake, the desire which often possesses strong, masterful men, to have a hand in the direction of public affairs, with no thought in their mind of personal aggrandizement. Politics to some men is a diversion, a game rather than a serious occupation. The satisfaction they derive from it is the thrill of seeing the puppets dance to the pulling of the strings which are in their control. For this pleasure they are often willing to give unstintingly of their time and money, as they would for any other entertainment which pleases them. If Ferdinand Roebling wanted nothing for himself, he was always glad to help his friends in their ambitions for office, and during the period of his political activities and influence he was instrumental in many instances in thus doing. For his own part he accepted only positions of honor which carried no emoluments with them.

Certainly the influence of Mr. Roebling was the paramount

FERDINAND WILLIAM ROEBLING

cause for the rapid political advancement of his brother-in-law, Frank O. Briggs, who was successively, mayor of Trenton; treasurer of the State of New Jersey; chairman of the Republican State Committee; and finally United States Senator. Mr. Briggs was for many years associated with the Roeblings, being at the head of the Wire Cloth Department and assistant treasurer of John A. Roebling's Sons Company. He was a graduate of the West Point Military Academy and had served for a period in the Army, having attained the rank of captain when he resigned. Captain Briggs was a man of high character and ability, but as the game of politics is played, or rather was played in those days, it would hardly have operated in his favor had there not been behind him the potent influence of a dominant political leader.

In line with the observation of Colonel Roebling, made in the course of a tribute to his brother, printed subsequently in this chapter, to the effect that Ferdinand had long cherished an ambition to become United States Senator, Mr. James Kerney, publisher of the Trenton Times Newspapers, is authority for the statement that when an opportunity arose, in 1907, to gratify this desire, Ferdinand put it aside in the interest of his brother-in-law Frank O. Briggs. Mr. Kerney, in relating the incident, said:

“When the political situation, in the winter of 1907, became so tense that John F. Dryden could not be reelected to the United States Senate without resorting to unwholesome manipulation of legislators, Mr. Dryden refused to have any further dealings and manfully declared himself out of the hectic contest. A conference of the Republican leaders of the State was called at the club house of Colonel A. R. Kuser, Mr. Dryden's son-in-law, in late February. I went to the conference with Mr. Briggs, who had been mayor of Trenton and was

THE ROEBLINGS

then State treasurer and chairman of the Republican State Committee. Mr. Roebling was there, as were Senator Dryden, David Baird, Sr., Daniel S. Voorhees, and other controlling party big-wigs. When Mr. Dryden declared that he felt he had done everything that an honorable man could do for his country and his party and that he had reached the decision to retire, he turned to Mr. Roebling and said: 'We will gladly throw our support to you.' The others expressed themselves in entire accord, but Mr. Roebling shook his head, remarking: 'I am too old; Briggs is the best man to get behind.' And so they united on Mr. Briggs, who was duly elected by the Legislature the following week. Mr. Roebling could have been elected, if he had only said the word. *The Newark Evening News*, which had strenuously opposed Mr. Dryden's return to the Senate, had editorially suggested Mr. Roebling as a compromise candidate."

PERSONAL CHARACTERISTICS

Generous with his gifts to the various charities of the city, there was no ostentation in his benefactions and probably most of these were never known to the public. The many kindnesses, both in money and personal interest, which he freely bestowed in individual instances of need which were brought to his attention, will never be known except to the recipients. He would never give to any object simply because the cause was a popular one, or because others were doing so. When solicited in such cases he would peremptorily refuse, often assigning no reason.

In his relations with his employees Ferdinand was kind and considerate, though he expected and exacted a full measure of service from them and was impatient of any slackness. Like his brothers his life was bound up with the interests of the company, though unlike them, as previously observed, he sed-

FERDINAND WILLIAM ROEBLING

ulously cultivated outside associations and thus was well known in a world to which his two brothers were more or less abstractions. Their great abilities as engineers were of course recognized in professional and industrial circles, but it was "F. W." who was the man to see and convince, when any business proposition was under consideration. Ferdinand stood pre-eminently for the Roeblings in the world of affairs.

If you spoke the name, "Roebling," in these circles it was always Ferdinand who was thought of, as in engineering it was the Colonel or Charles. It all depended upon the point of view and the special interests involved. Popularly, of course, meaning thereby the general outside public, it was Colonel Washington Roebling, the engineer and builder of the Brooklyn Bridge, who was thought of exclusively as *the* Roebling. To this public Ferdinand or Charles was practically unknown, for the Colonel's fame naturally overshadowed both.

Who was the greatest of the three brothers is a question therefore that will be answered differently according to the standpoint of the respondents. But all competent to pass judgment would probably agree that as a triumvirate of one family it would be difficult to find their superiors.

AN APPRECIATION OF FERDINAND W. ROEBLING, BY HIS BROTHER, WASHINGTON A. ROEBLING

At an early day John A. Roebling recognized the business ability of his son Ferdinand. He often told me that he was the only one of his sons who had the true genius of the merchant. When the Civil War broke out his services were so valuable that his father refused to let him go.

At that time wire rope was still made on the old rope-walk. The amount was small, only 700 tons being the annual output when his father died. The office work could still be done by "F. W."—and a helper—his cousin Riedel—and later Harris.

THE ROEBLINGS

In fact, the elder Roebling thought his rope factory was big enough; he had no desire to extend. But with his death in 1869 a new spirit began to prevail. The rope-walk, with its limited capacity, had been replaced by rope machinery in a compact building; it became imperative to capture and retain the new business coming along. For a time "F. W." and Charles Swan ran the business, the only competitor being the Hazard Company.

The introduction of Bessemer steel became a new factor, as it bid fair to replace Swedish iron entirely. Its use brought in new problems which had to be learned by hard experience. In 1871 Charles Roebling left college and entered the business as an active member. "F. W." retained the commercial end of it with Charles as the manufacturer and builder, as he is today. Mr. Swan retired shortly afterwards. New problems came pressing along. Galvanized wire had been frowned on by the elder Roebling; he would have none of it. The horizontal Smith machine (brought over from England in 1868 by "W. A. R.") was also condemned because it put a twist in the wire with every revolution. It was not used during the lifetime of the elder Roebling, whereas today, it forms one-half the rope machinery. About the last rope made on the rope-walk was a No. 10 elevator rope. The attempt was not very successful, the wire being too fine for the long stretch. On the new strand machines they were made easily and have remained our chief standby to the present day. After the art of galvanizing had been somewhat perfected, the next step was to replace the old oiled telegraph-wire with galvanized wire, thereby opening up an endless vista for the sale of that wire which still continues.

Here Ferdinand's talents came into special play, in getting orders, making contracts, cultivating friendly relations with

FERDINAND WILLIAM ROEBLING

the many new companies constantly springing up, and sometimes taking stock in payment, which did not always prove remunerative.

Enlargements and increases became the order of the day, made entirely out of our own profits, no outside capital ever being required.

A change in the tariff made it advisable to make our own charcoal iron, all of which had to be learned through costly experimenting. The original rolling-mill had already been removed and improved; a new huge wire-mill was erected on Elmer Street. Fortunately this was not all done in a day, but the responsibilities, the thinking and planning, went on all the time. Competition grew and had to be fought, in which particular respect Ferdinand was a good fighter.

With the good news came also bad news. The fine wire-mill, erected to make binder wire, suddenly found itself out of business and without orders. Nothing daunted, a wire-cloth factory was immediately determined on to consume the fine wire. A great success at first as regards profits, it gradually dwindled down to a 10 per cent or 5 per cent basis, after all the original looms had long ago been junked. But today the output of fine wire must be nearly fifty-fold what it was then. The old bath-house office had been long before exchanged for the Roebling dwelling-house, giving ample room for the increased commercial and bookkeeping demands.

I wish, however, to say right here that this fragmentary account of the early history of the Roebling plant is only introduced incidentally for the purpose of showing how Ferdinand's mind rose to the occasion, how no opportunity for advancing the business was neglected, how old processes were perfected, and how quickly new ones were adopted and the old ones scrapped.

Inseparably interwoven as his activities were with those of his great brother Charles, he still had a most distinctive personality of his own which he never failed to assert, always towards a common end with but few mistakes, as business matters go. Sometimes the sober second thought neutralizes a mistake; such, for example, as throwing our business away to the United States Steel for a song.

Then again it is so easy to jump into a new speculation and so difficult to withdraw without great loss, such as the faculty of cutting a loss, which is seldom exercised at the right time, until you are an old man, and then it is too late.

As business grew and prospered Ferdinand's mind broadened and looked farther into the future. To swim with the current is easy, but to weather the periodic reverses which always come, only aroused in him a dogged resolution to fight it out. When sunshine appeared again after reverses he was one of the first to recognize it and take advantage of the new conditions.

At home Ferdinand was a most genial host. When you had crossed his threshold all antipathies were forgotten. While just and fair to his office force, he had the faculty of making them understand their position and their duties.

Although never an office-holder, he took a most active and personal interest both in local and national politics, and always regretted that he had not become United States Senator, a position for which he was eminently fitted. He took great pride in being a delegate to the national presidential conventions. He became intimately acquainted with the prominent men of the Republican Party; his advice was listened to with respect.

Too often antagonism ends in lifelong animosity. Of that he had his share. While not a public speaker, he could talk well and to the point about business affairs in the business

FERDINAND WILLIAM ROEBLING

meetings of the many combines that sprang up some twenty years ago. A supersensitiveness, where no slight was intended, has cost him many a pang.

The secret of success in many a business consists in the ability of weathering hard times, of keeping your organization intact, in keeping your working men employed, even at a small loss. That he always looked out for. In later life his optimism was tempered by considerable caution.

History teaches us that no man can be great unless a certain amount of vanity and self-esteem enters into his composition. Of that Ferdinand certainly had more than a trace. To be important you must first of all have a good opinion of yourself. It is necessary in order to impress others.

He had the pleasure of seeing branches of the business, which commenced with the humblest beginnings, develop into the most important departments, such as the Flat-Wire Shop Department, for example. The Insulated-Wire Department, on the other hand, has had a very chequered career.

When the great addition to our plant was begun at "Roeb-ling" (the creation and chef-d'œuvre of Charles Roeb-ling) it also became necessary to establish new stores, new agencies and connections—in fact, to do a world-wide business; all of which Ferdinand attended to with the skill and judgment born of long experience and intuitive knowledge of the character of men. The office itself was doubled in size and new methods of bookkeeping were introduced. This work expanded so much that it was no longer possible to give the vital personal touch to every new proposition. The problem could only be solved by the introduction of separate departments, as it is today.

Any allusion to distinctly personal characteristics is always a delicate matter. I am a great believer in heredity. Fully nine-tenths of our qualities are the consequence of direct inheri-

THE ROEBLINGS

tance; the other tenth comes from experience, from contact with the daily business surroundings, usually forced upon you by circumstances and also by chance. Chance plays a large part in our progress through life. In my brother's mental attributes I could see the combination of a father's terrific energy, tempered by the calm and good sense of a devoted mother.

To get ahead of a competitor, by even one year, he considered good policy. He knew that conciliation and cooperation produced better results than an open fight to the death.

From one great trouble which besets most corporations he was happily freed. I mean the matter of funds. Owing to his own conservatism, coupled with that of his brothers, there were always ample means at hand for enlargements, improvements, and for experimenting, the latter being an important item. I do not wish to convey the impression that every venture was a success. A very few were bonanzas; others were disastrous failures, persisted in until utterly hopeless. In others again profit was sacrificed to gain reputation.

When two disastrous fires had visited our plant, I was struck by the philosophic calm with which Ferdinand received the news. I could not quite understand it. It must be that with advancing age the mind realizes that you cannot control everything and must bow to the inevitable.

There is one other point in which I am sincerely grateful to him: during the years that I was incapacitated by illness, he carefully and honorably preserved my interests in the business, which meant a great deal to me and mine.

As time goes by, our memories retain only the good; the other things fade away.

What death really means I do not understand, and do not want to. We enter life without knowing it, and leave it unconscious. Cut off thus at either end, all we can do is to obey

FERDINAND WILLIAM ROEBLING

the dictates of the infallible conscience with which we are endowed by nature.

But who succeeds in doing that?

(Written in loving memory by his brother.)

Trenton, N.J.

April 15, 1917.

CHAPTER XVII

CHARLES GUSTAVUS ROEBLING

Engineer and Master Builder, 1849-1918

As THERE will appear in a subsequent chapter an intimate and comprehensive survey of the professional achievements of Charles G. Roebling proceeding from the pen of his eldest brother Washington A. Roebling, it will be only necessary here to give a brief preliminary outline of his career.

Charles G. Roebling was the third son of John A. Roebling and Johanna Herting Roebling and was born in Trenton, December 9, 1849, in the original Roebling home which stood on a site adjacent to the Roebling mansion afterwards erected in 1856, and subsequently occupied by the main office of the Roebling Company. He received his early education in the primary schools of the city and afterwards was sent to a boarding-school on Staten Island kept by a relative, where he prepared himself to enter the Rensselaer Polytechnic School at Troy, New York. He was graduated from that institution in the class of 1871, with the degree of C.E., two years after his father's death. By his father's will, in accordance with which his four sons were to acquire the business, he inherited his proper interest in the firm of John A. Roebling's Sons, besides his portion of the general estate. He began immediately to take an active part in the industry, devoting himself exclusively to the engineering and manufacturing departments.

CHARLES G. ROEBLING ENTERS THE INDUSTRY, 1871

When Charles began his labors the industry was a small, though a growing and profitable one, and the plant consisted



*Charles Gustavus Roebling, President, John A. Roebling's Sons Company,
1877-1918*



Portrait of a person, possibly a historical figure, shown in a very faint and low-contrast format. The image is centered on the page and appears to be a reproduction of a photograph or a drawing.

CHARLES GUSTAVUS ROEBLING

of a single mill for the manufacture of wire rope, employing about one hundred men. The business expanded rapidly under the forceful management of his elder brother, Ferdinand, who was in full control of the financial and selling sides, as Charles was of the mechanical. Washington was at that period engaged in the work of constructing the Brooklyn Bridge, which required all his time and energy and thus was able to give only occasional attention to the affairs of the company. Long before the completion of the great bridge, in 1883, Colonel Roebling's health had been so impaired by the illness occasioned by his strenuous labors that he was henceforth incapacitated for active work, and the two brothers, Ferdinand and Charles, thereafter divided the responsibility between them. When John A. Roebling's Sons Company was incorporated in 1876 Washington Roebling became president, but was subsequently succeeded by Charles, who held the office up to the time of his death, his brother, Ferdinand, being secretary and treasurer. From the outset the combination was a highly successful one, Ferdinand's astute financial management and extraordinary business genius being the complement of Charles' unfailing industry and skill on the engineering and manufacturing end. During the nearly fifty years' association of the three brothers, following the death of their father, the result shows that they had maintained a full measure of the extraordinary talents, enterprise and industry which so notably marked the character of the father and founder of the business.

With increasing demands for wire which succeeding years brought, due to the opening up of ever fresh avenues for its use, the need for expansion of the plant and for new machinery adapted to modern processes became evident and these things were Charles' special charge. The single mill which existed in 1869 was supplemented as time went on by many others, now

THE ROEBLINGS

embraced in three general groups of the company's property: the upper or main Trenton plant, the Buckthorn plant and the extensive mills located in the industrial town of Roebling, New Jersey. All the factories and the machinery in them as constituted in 1918 were designed and erected by Charles to care for the ever-increasing business demands created by Ferdinand's tremendous driving power, as a wide-visioned business organizer and super-salesman.

SOME ENGINEERING ACCOMPLISHMENTS

Besides his routine work at the mill, Charles designed and built the Oil City Suspension Bridge at Oil City, Pennsylvania, and was responsible for the manufacture and placing of the cables of the Williamsburg Suspension Bridge at New York.

One of his most notable engineering feats was in connection with the removal of Cleopatra's Needle from Egypt, given to the United States in 1877 by the then Khedive, and its transportation and erection in Central Park, New York, in 1880. In this connection it will be recalled that the late William H. Vanderbilt subscribed \$100,000 towards defraying the cost of removal. To Lieutenant-Commander H. H. Goringe of the U.S. Navy was assigned the task of transporting the obelisk. The monolith, according to his measurement, was 69 feet 6 inches in height, 7 feet 9 inches in thickness at the base and weighed 44,800 pounds. To remove it from its site in Alexandria and transport it in safety to its resting-place in Central Park was an engineering problem of the first magnitude.

After Commander Goringe had prepared the preliminary plans he concluded to consult a leading mechanical engineer as to their practicability. Accordingly he visited Charles Roebling in Trenton, exhibited his plans and asked for a frank opinion as to their working value. After some pointed ques-

CHARLES GUSTAVUS ROEBLING

tions had been put to him by the engineer, Gorringe frankly confessed that the job was too big for him without expert assistance and begged Mr. Roebling to go over the plans and revise them according to his own judgment. Accordingly new plans were prepared and special machinery for transportation was designed and built at the old Phoenix Iron Works in Trenton. A selected crew from the Works went to Egypt to superintend the work of removal and transportation. When the monolith was finally set up it was intact, and the engineering profession was a unit in eulogizing the skill which brought the task to a successful conclusion.

THE TOWN OF "ROEBLING" A MONUMENT TO CHARLES G. ROEBLING

Undoubtedly the supreme achievement of Charles' career was the building of the industrial town of Roebling, a vast undertaking which took years of planning and sustained effort to complete, and represents today the founder's visible monument as a master-builder and mechanical engineer. A full chapter in this book is devoted to the story of this enterprise, which, had it not been undertaken at the time in accordance with the wise foresight of the company to meet an ever-increasing competition, would have proved a serious handicap in maintaining the company's ability to get its full share of business as against its powerful rivals in the trade.

An extraordinary number of fires, which from time to time completely demolished various buildings full of costly machinery, occasioned tremendous losses and put an extra burden upon Charles' time and energy, but he met these emergencies with unflinching courage and resolution. He was always a tireless worker. He gave of his days from eight in the morning until six at night and probably wore himself out prematurely.

THE ROEBLINGS

HIS RECREATIONS AND HIS FAMILY

His recreations were few and he seldom took a vacation. His only hobby, except his love for music, was the cultivation of orchids, of which he possessed a choice and valuable collection, as the awards made at public orchid shows in New York, Philadelphia and Boston bear testimony.

The death of his only surviving son, Washington A. Roebling, 3rd, a young man of many endearing qualities, who perished in the *Titanic* disaster in 1912, was a terrible grief to him, and it was feared at one time would result in serious consequences to his health. When the church which the family attended in Trenton was undergoing restoration Mr. Roebling, at his own initiative and to the memory of his son, rebuilt the whole west wall of the edifice and filled it within and without with costly stone statuary, besides providing for the insertion of specimens of fine English stained glass, making this portion of the church probably the most elaborate of any parish church in this country. A free hand was practically given to the rector to make the restoration and embellishment satisfactory to himself, regardless of the expense. Mr. Roebling was also accustomed to send his gardeners to decorate the church at Easter with the orchids and other rare plants in his conservatory, and he himself was an invariable attendant at the services on such occasions.

Mr. Roebling cherished a distaste for public life, though he took a deep if quiet interest in political affairs. He served as a member of the State Legislature in 1903, but declined a reelection. He was also for a short time a member of the city Water Board. Besides his position as president of the John A. Roebling's Sons Company he was also president of The New Jersey Wire-Cloth Company and was associated with several subsidiary corporations. He was a member of the American



Mrs. Charles G. Roebling, née Sarah Ormsby



Charles G. Roebling as a Young Man, circa 1875



*Washington Augustus Roebling, 3rd, Son of Charles G. Roebling,
Lost on the S.S. Titanic, 1912*



*Mrs. Richard McCall Cadwalader, nee Emily Roebling,
Eldest Daughter of Charles G. Roebling*

CHARLES GUSTAVUS ROEBLING

Institute of Mining and Metallurgical Engineers and the Engineers' Club of New York.

He died after a short illness as the result of Bright's disease, October 5, 1918, doubtless aggravated by, if not directly due to, overwork and excessive strain. He lies buried in Riverview Cemetery, Trenton, in which city he had spent his entire lifetime of sixty-nine years.

Charles Roebling married, January 25, 1877, Sarah Mahon Ormsby of Pittsburgh. For some time previously the young lady, owing to the death of her parents, had made her home with relatives in Trenton, and it was at their house that her future husband made her acquaintance. Mrs. Roebling was a woman of rare beauty and charm. She only lived for ten years after her marriage, dying January 15, 1887, in the thirty-second year of her age. Five children, including one dying in infancy, were born to the couple: two boys, Harrison Ormsby, born November 7, 1877, died January 12, 1883, and Washington Augustus, 3rd, born March 25, 1881, died April 15, 1912; two girls, Emily, born September 9, 1879, and Helen, born December 15, 1884. The two girls survived their father's death. Emily was married to Richard McCall Cadwalader of Philadelphia, and Helen, October 16, 1912, to Carrol Sargent Tyson, Jr., of the same city. Two Tyson grandchildren, Charles, born February 22, 1914, named for his grandfather, and Helen, born May 16, 1916, were their grandfather's solace and happiness. Mrs. Cornelius W. Hook, a sister of Colonel Washington Roebling's first wife, Emily Warren, had been a member of Charles' household ever since the death of his wife and had presided as the lady of the home and acted as the foster-mother of the young children. She survived his death only by a brief period.

At his death Charles was probably the wealthiest of the

THE ROEBLINGS

three brothers. He is said to have been the largest individual stockholder in the Pennsylvania Railroad in the State of New Jersey. His estate was left in trust to his two daughters.

Like all the Roeblings, Charles lived unostentatiously. He indulged in no expensive tastes, unless in the matter of his orchid-growing, and in this respect he did not scruple to spend large sums to procure the rarest specimens. He usually spent his Sundays in visiting his greenhouse and in consultation with his chief gardener. He was always willing to permit those interested to inspect his collection and he thus formed many pleasant associations with those who indulged in the same hobby. Some of the species created by hybridizing, which originated in his greenhouse, were unique and brought great fame to his collection.

TALENTS AND TRAITS

Though a skilful performer on the piano, he would play only for his own pleasure or at rare intervals for his family and intimate friends. Allusions to his skill seemed to irritate him, and he always on such occasions quickly changed the subject. On the few occasions when he gave social entertainments in his own home he was a gracious host, though he possessed no fund of small talk or light banter. He seldom gave way to open laughter, though he evidently enjoyed a good story, if he seldom told one himself.

He made one trip abroad for business purposes, but never seemed to wish to repeat the experience. Trenton, where he had grown up and where his business interests were, sufficed him, and his local circle of friends and acquaintances provided all the society for which he had leisure. His two daughters, handsome, sprightly girls, as they grew up brought a more cheerful atmosphere into his home, until they were married and

CHARLES GUSTAVUS ROEBLING

had acquired homes and interests of their own. Thereafter he commonly spent his leisure hours in reading, often the stiffest works. There was hardly any subject ranging from botany to metaphysics in which he was not well informed. His mind was analytical like his father's and he never left a subject until he had mastered it. Perhaps his conspicuous deficiency was a lack of humor, which tended to make him take too serious a view of petty annoyances and led him to cherish antipathies engendered by trivial occurrences.

He had a rooted disinclination for letter writing and when he did write personal letters, in response to communications from his friends or others, he made them as brief as possible. He would often delay his reply, when he made one, for several weeks, leaving his correspondents wondering if he had ever received their communications. Perhaps a month afterwards, meeting them casually and without alluding to the letter, he would bring up the subject, which presumably he had entirely forgotten, and indicate his mind in the matter.

He disliked garrulous people and usually met their remarks with complete silence. Indeed, he had a positive genius for reticence. It was always hard to get him to express an opinion or pin him down to a definite answer.

He would often step into the Lotus Club in the late afternoon, when it was much frequented, and after looking about and silently noting who were present, stand apart by himself gazing out of the window, never exchanging a greeting or venturing a remark. Then he would depart in silence as he came.

Adjacent to his house was a small meadow in which a cow was sometimes pastured. There was a gap in the fence connecting his place with a neighbor's property, and one day the cow incontinently strolled over the line and proceeded to make havoc of the neighbor's fine kitchen garden. A note was written

THE ROEBLINGS

to the cow's owner protesting against the intrusion, to which he never replied. But the fence was immediately repaired and some weeks later Charles did an extraordinary thing for him; he made a formal social call upon the family, remaining some half hour, but without speaking a word about the trespass. That was simply his way of offering an apology and as such it was accepted and the incident closed.

A humble neighbor, a woman who lived opposite his home in a small house which she rented from him, had the temerity to call upon him with the request that he should order some trifling repairs to be made. He made no comment at the moment, but in a day or so he himself made a personal inspection of the premises, and not only made the repairs asked for, but completely renovated the building, adding many new comforts and conveniences. When his humble tenant who became fearful that all these improvements meant that her rent would be raised, protested that she could pay no more than she had been doing, he gruffly replied: "Wait until you are asked," and the rent thereafter continued the same.

Many stories are told of his kindness and consideration extended towards his employees, of which one or two instances may be appropriately given here.

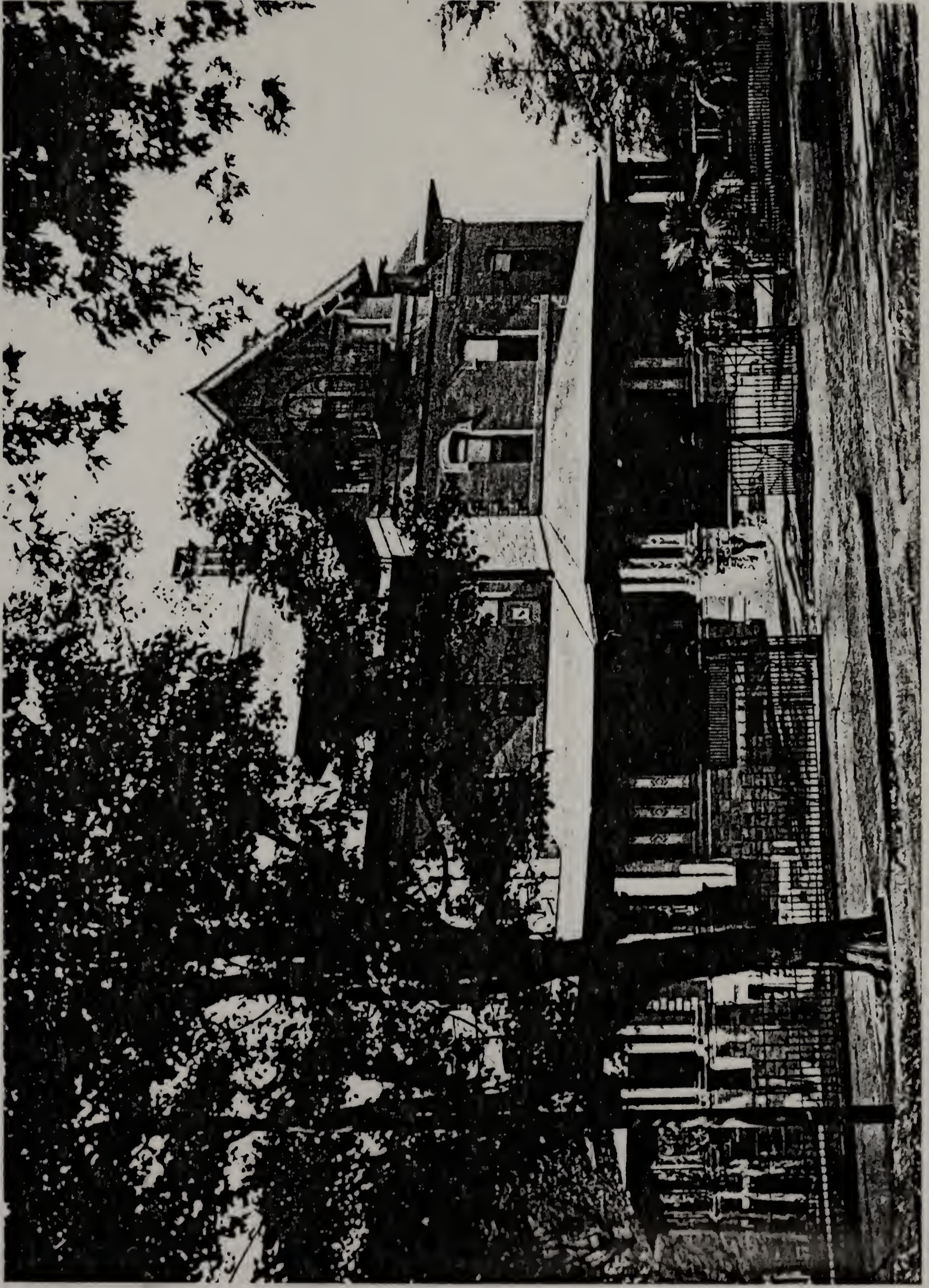
A clever young man had been recently advanced to the superintendency of one of the departments. Charles, who was in the habit of making casual visits to the various shops, with no apparent object in view, seemingly seeing nothing but actually noting everything with his quick glance, suddenly turned to the young man in charge and said: "Where is So-and-So?" referring to an employee who had long been in the service of the company. "Oh, I have discharged him," was the glib reply. "I found the old codger several times asleep at his work and of course I couldn't stand for that." "Young man,"



*Mrs. Carrol Sargent Tyson, née Helen Roebing, Daughter
of Charles G. Roebing*



*Charles Roebing Tyson, Son of Mr. and Mrs. Carrol Sargent
Tyson and Grandson of Charles G. Roebing*



The Charles G. Roebling Residence, 333 West State Street, Trenton

CHARLES GUSTAVUS ROEBLING

said Charles, shaking an admonitory finger, "if you want to stay here you better get that old man back and see that he is paid his wages for the time he has been off." With that he turned on his heel and was gone without another word.

Here is another story:

A clerk in the employ of the company who had never supposed he was favorably known to his employer, had the misfortune to lose his father who was living in a distant town. The clerk, who was receiving a small salary and to whom the burial expenses involved in his father's death would have to be met out of his meagre earnings, went to the office, stated his case and asked for permission to take a few days off to attend his father's funeral and settle his affairs. Permission was given and the young man started to take his leave. He had got as far as the door when his employer called him back. "Have you got any money?" he was asked. "Not much," was the reply, "but there are some friends who I think will help me out." "How much do you need?" was the next question. "Perhaps two hundred dollars," was the response. "Go to the cashier and he will let you have what you require." Nothing was said as to whether this was a gift or an advance to be repaid out of his wages. The young man immediately went to the cashier and repeated the conversation. The cashier promptly gave him the money and asked how he proposed to repay the loan, and how much he thought he could afford to have taken out of his weekly pay envelope. The clerk mentioned a certain sum. The cashier nodded his satisfaction and the young clerk went his way. When pay-day came around again he found that his salary had been paid in full. So it continued to be on subsequent occasions. Finally, thinking that the matter of his indebtedness had been overlooked and being anxious to begin the regular payment of his obligation, he went to the cashier

THE ROEBLINGS

again and stated the circumstances. The cashier, with a twinkle in his eye, remarked: "Oh, I forgot to tell you that your salary has been increased by the exact amount you borrowed."

Here is an anecdote showing his sympathy for his workmen:

"I shall never forget," said a personal friend of Mr. Roeb-ling's, "a rebuke he once administered to me when I ventured to express some depreciatory remark concerning the drinking habits of some of the Roeb-ling workmen, which had been brought to my attention in the case of a drunken row, as related in the newspapers." "I presume you will discharge those fel- lows," I said. "The Roeb-lings can't stand for that sort of thing." "Discharge them!" thundered Charles. "Of course I'll do nothing of the kind. Haven't they a right to get drunk out of hours if they want to? That's their business, not mine. If you had to work for nine or ten hours before an open-hearth furnace I know damned well you'd get drunk yourself. You white-collar chaps who have never done any real work in your lives and have money and leisure to enjoy yourselves after your own fashion have no sympathy with the working man. He takes his pleasure one way; you take it another, that's all."

These anecdotes may seem somewhat trivial, but they surely tend to reveal the fundamental kindness of the man's heart and his innate sympathy with his fellow men of every degree, all hidden behind an exterior manner that commonly appeared cold and cynical to the superficial judgment of the world.

A TRIBUTE FROM A FRIEND

A tribute to the personality and character of Charles G. Roeb-ling from the pen of one of his friends, standing wholly apart from family or business circles, and written at a time when the memory of his loss was fresh in the mind, may per- haps fitly be reproduced here, leaving the more intimate ap-

CHARLES GUSTAVUS ROEBLING

preciation by his brother, Washington A. Roebling, to conclude this chapter:

“Charles G. Roebling, though he had lived in Trenton all his life and was the head of the largest and most notable industrial concern in the city, was a man whose personality was little known to the general public. A civil engineer by education and a diligent student of subjects connected with his profession, especially as they were related to the practical problems of his own business, he was also a man of broad general culture, of fine artistic tastes and of wide reading in departments of philosophy, history and literature. Probably there were few other men in Trenton who were in the habit of reading books that demand for their understanding such close application and such severe mental discipline. The range of his intellectual interests was a catholic one and embraced metaphysics, theology and science as well as the lighter forms of literature and current happenings. He had a keen appreciation of art, a technical understanding of music and a passion for botanical and floral forms, as his collection of rare plants and orchids witnesses to.

“Seldom indulging in the diversions of social life and content to spend his hours of leisure quietly in his home and in the cultivation of his personal tastes and hobbies, he sedulously avoided publicity. Though having many acquaintances, he yet cultivated few close friends and intimates. Naturally reticent, and indisposed to commit himself to others, he yet attracted to his orbit a certain few to whom his society and companionship afforded a peculiar fascination. Beneath an apparently brusque manner and a tendency to dispute every proposition which was advanced, he hid a nature of extreme sensitiveness, of tender sympathy for suffering and of unquestioned loyalty to the claims of his family and friends.

THE ROEBLINGS

“Caustic, and even cynical, as he sometimes seemed to be, these traits were only superficial blemishes in his character. Beneath the surface there was a large tolerance, a deep stream of compassion and a generous appreciation of all that was good, true and beautiful. An unwillingness to conciliate those who might possibly misjudge him did not imply a real indifference to their opinions so much as an instinctive shrinking from exposing the secret of his character and personality to the common view. He did not let his light shine before men, but rather muffled the flame and purposely refrained from exhibiting virtues, which, if disclosed, would have won him public approbation.

“When he did a thoughtful and generous act, as he did many in ways unknown to the public, he deprecated any expression of gratitude on the part of the beneficiaries. He bestowed his favors and gifts, as it were casually, and seemed to wish to hear nothing more about the matter. Possessed of large means he had nothing of the plutocratic spirit about him. He seldom alluded to money and when he did so it was always in a detached way as though it had no personal interest for himself. He was proud of the great enterprise of which he was the head but he never talked of its achievements and successes; indeed, he seemed to regard them as belonging to the natural order of things and thus needing no comment.

“Though apparently an unobservant spectator of what was going on about him, nothing escaped his keen eye. His memory for chance conversation and casual observations was remarkable and exact. Weeks afterwards he would often surprise his friends by recalling matters to which at the time he seemed to have paid absolutely no attention.

“Fastidious in his personal tastes and habits, and always

CHARLES GUSTAVUS ROEBLING

bearing himself with the greatest dignity, he was democratic in his feelings and informal in his relations with his friends.

“If he was a man whom it was difficult to understand on short acquaintance, the longer and more intimately he was known to his friends the deeper became their appreciation of the richness and variety of his personality and attainments. Recognition of the fine spirit of the man came by degrees. The truth concerning him was not so much apprehended intellectually as divined by the power of an intuitive sympathy.

“The study of such a complex character is a baffling task, for it is pursued under peculiar difficulties. It would often seem that there was a deliberate attempt on his part to throw the observer off the track, to defy him to get at the heart of what he was.

“Religious in the large sense of the term, if approval of all that is truest and best in human aspirations may properly be so termed, he probably held no formal scheme of theology. He believed in churches and supported them, even where he had little sympathy with their dogmatic teachings. ‘Every man,’ he once remarked, ‘has a right to his religion and deserves help in maintaining its practice.’ ‘The greatest sin,’ he once observed, ‘is wilfully to hurt the feelings of another person.’ While hesitating to commit himself to any positive belief in human immortality he yet expressed an intense longing for it and probably cherished an implicit hope in it, though he was unable, perhaps, to justify that hope to the intellect.

“The outward facts concerning the life of such a man afford only a small clue to his true character and personality. The real history lies concealed in the inner arcanum which enshrines the seat of the spirit.

“If the subject of this tribute could read what is here writ-

THE ROEBLINGS

ten he would probably dispute most of the statements, so far at least as they suggest any eulogy upon himself.

“Charles G. Roebling more than most men was an enigmatic and unique personality. To the world at large, and even in the case of those who came in casual intercourse with him, he was probably misunderstood, or at least not appreciated at his true value. But to one of his friends he was all that this tribute indicates, and his taking away is the occasion of unflinching regret and profound sorrow.”

IN MEMORIAM

CHARLES G. ROEBLING

WRITTEN BY HIS ELDER BROTHER, WASHINGTON A. ROEBLING

Born December 9, 1849

Died October 5, 1918

There may be some people living whose sole activities can be confined to two lines such as these, others who have done a little more than living and breathing.

But at rare intervals, once in a century, a man appears who towers so high above his fellows that his activities and accomplishments surpass a hundred-, yes, a thousand-fold those of the average man. Such a man was Charles G. Roebling.

I am a strong believer in heredity. He was his father over again, to a far greater degree than any of the other children. He inherited his temperament, his constitution, the concentrated energy which drives one to work and be doing something all the time. It might be argued that if a man inherits everything he deserves no credit for what he is. That would be so in a life of universal monotony, but with each generation in turn totally different conditions and environments arise. These have to be met by the new individual, who must develop his

CHARLES GUSTAVUS ROEBLING

own powers to adapt himself to them, to overcome them and use them as his tools.

The early childhood of Charles passed along rather peacefully. The father was away much of the time at Niagara, Pittsburgh and Cincinnati, so the boy was spared the educational experiments which were applied so disastrously to the older boys (scolding and cowhide). As he grew older the inherent impulsive traits began to show themselves as this little incident will show. While standing at the door one day, a beggar woman came along asking for old clothes. Charles rushed upstairs to his mother's closet, seized an armful of costly silk dresses, and bestowed them on the astonished mendicant, who marched off with them.

The boy was not christened as a child; his father waited until the two younger boys were ready to march with him to the First Presbyterian Church, where a pew was maintained to enhance the family respectability. My mother was a Lutheran and father more of a Universalist, until he evolved a religion of his own, a thousand written pages of which are still mouldering in a trunk in the garret, forgotten and unread. Charles was baptized without a middle name. A little later he noticed that his older brothers rejoiced in one. As he could not bear the thought of being outdone in anything, he selected the middle name of Gustavus of his own accord.

Charles' older sister, Laura, had married a German school teacher from Muhlhausen named Methfessel, who established a boarding-school and pedagogium in Stapleton, Staten Island. Thither the boy was sent when he was twelve or fourteen; he thrived under his sister's motherly care and followed the usual academic course for three or four years. He developed great ability as a piano player, and became a brilliant performer, by far the best in Trenton. (His father before him had been

THE ROEBLINGS

a virtuoso on the flute and piano until his left hand was maimed.)

It might be supposed that Charles in such surroundings would continue the use of and become adept in the German language, but he never acquired it and soon forgot the little he knew, so different from his oldest brother, who still speaks it with the same fluency as English.

When he was eighteen he was sent to the Rensselaer Polytechnic at Troy, where I had graduated in 1857.

During all these years I saw very little of Charles. While I was at Troy he was a small child, afterwards I went to Pittsburgh for several years and saw nothing of him. Then came four years of Civil War and three years on the Cincinnati Bridge. When my father died and I undertook the Brooklyn Bridge, he still had two years to serve in Troy. . . . I did not see Charles at Troy. He did not fancy the usual family boarding-house, and occupied rooms above Vanarnum's saloon, eating where and when he pleased. Out of his class of 28 (in 1871), 18 are dead. (Only two are living in my class.)

He did not seem to have formed any warm attachments with any of his classmates, as is usually the case. I very seldom have heard him allude to any of them. He was already beginning to develop a certain brusqueness of character which repels rather than draws people to you. I have at hand an ambrotype taken when he was twenty-one, wearing a high stovepipe hat, with a perfectly smooth face and still capable of doing boyish tricks. He was a fine draughtsman and fair at mathematics, and learned more about machinery than I did.

When Charles graduated in 1871, he came at once to Trenton where everything was prepared for him to make his entrance into business life an easy one. His father was dead, he

CHARLES GUSTAVUS ROEBLING

was his own master; his guardian, Charles Swan, my father's old superintendent, turned over to him over \$300,000 in good securities. He took his place as an equal partner in the partnership of the two older brothers, Washington and Ferdinand, established by the father's will. Being an educated engineer he naturally took to the manufacturing end of the business. He did not have to go through the grinding apprenticeship that most young men have to undergo.

The history of Charles G. Roebling is practically the history of the Roebling Company from now on. But before proceeding would remark that it is always a delicate matter to say anything about a decedent's family life, or his personal peculiarities. Charles had married a beautiful and highly accomplished woman, who bore him five children, of whom only two survived at the time of his death. She died shortly after the birth of the last one, Helen, when Mrs. Hook, my sister-in-law, came in and took charge of the household. The oldest boy, Ormsby, the father's pride, died at the age of six of diphtheria. This was as much of a shock to him as the death of Washy, years later, on the *Titanic*. When so many children die a man's heart becomes callous and hardened, he loses his faith in Providence and just falters along with his dreary burthens.

Charles was born with a "high blood pressure" constitution. Persons thus endowed have their destiny marked out for them. It forces them to work hard to the end of their lives; there is no rest for them. Thus we find him down at the mill every day in the year, early and late. That was his pleasure and delight. He shared it with his brother Ferdinand. An occasional business trip gave him all the relaxation he needed. He was not a public orator, but down at the mill in his own province, he could be fluent enough. When someone had done wrong he

THE ROEBLINGS

could annihilate him and then be a little sorry (perhaps). To his daily associates his outbursts of unbalanced excitability did not mean so much, because he always calmed down. He was very outspoken in his opinions, and never hesitated to give them in full force, no matter who was hurt by them.

In later life he became a little more politic. These are apt to be the characteristics of a man who has always had his own way. When brothers are together in business the proper amenities are frequently neglected. Not to speak to each other for six months was by no means uncommon, and still the business went on; each one performed his part with grim determination.

Charles had one very strong point—he never copied; tried to solve every problem according to the best of his ability. Every task was an education to him. This is not always the cheapest way. Later on, when he had too much on his shoulders, he would sometimes pay for ideas.

Everyone who came in contact with him in a business way was impressed by his ability and power, but in arguing with him you had to be sure of your ground, else you would be met with a snort of disdain. Charles did not like to write. I have never received a letter from him. A few scraps and memoranda were enough for him; he trusted much to his memory—even about such important subjects as the cables of the Williamsburg Bridge he never wrote a line. He might at least have written a short monograph so as to get credit. He loved his work; it was his life, his happiness. In investments he preferred railroads, kept away from electric roads. Having been once bitten by a municipal, he owned none when he died. His death made a gap in our forces at the mill which will be felt for many a long day.

Written in loving memory by his brother,

WASHINGTON A. ROEBLING

CHARLES GUSTAVUS ROEBLING

A LETTER IN REPLY TO A FRIEND AND NEIGHBOR

TO MRS. STOCKTON:

Dear Madame: Your kind and sympathetic note touches my heart. By the death of Charles I not only lose a friend and brother, but Trenton loses its greatest citizen and the country at large its foremost mechanical engineer. He was a paragon of industry. We all relied upon him. With his wise counsel, his instant decision and effective action we all felt we had a strong tower to lean upon. We already miss him and look around in vain for someone to take his place. . . . Time, which usually heals all things, cannot replace him. Coming so soon after the death of F. W. it seems like a double stroke of fate. He was never aware of his real condition until it was too late. In the face of a growing weariness he kept on planning and working until sheer exhaustion forced him to his bed, from which he could never rise. Most men would have taken alarm in time, but that was not his way. He preferred to die in harness.

One winter evening, on December 9, 1849, I was sitting next a room where a woman was in labor; presently I heard the faint cry of a new-born child. Last Saturday I heard the last sigh of that same child. When I think back on the great work, the vast accomplishments and undertakings achieved between these two sighs, it surpasses my understanding. May he rest in that peace of which he saw so little during lifetime.

W. A. ROEBLING

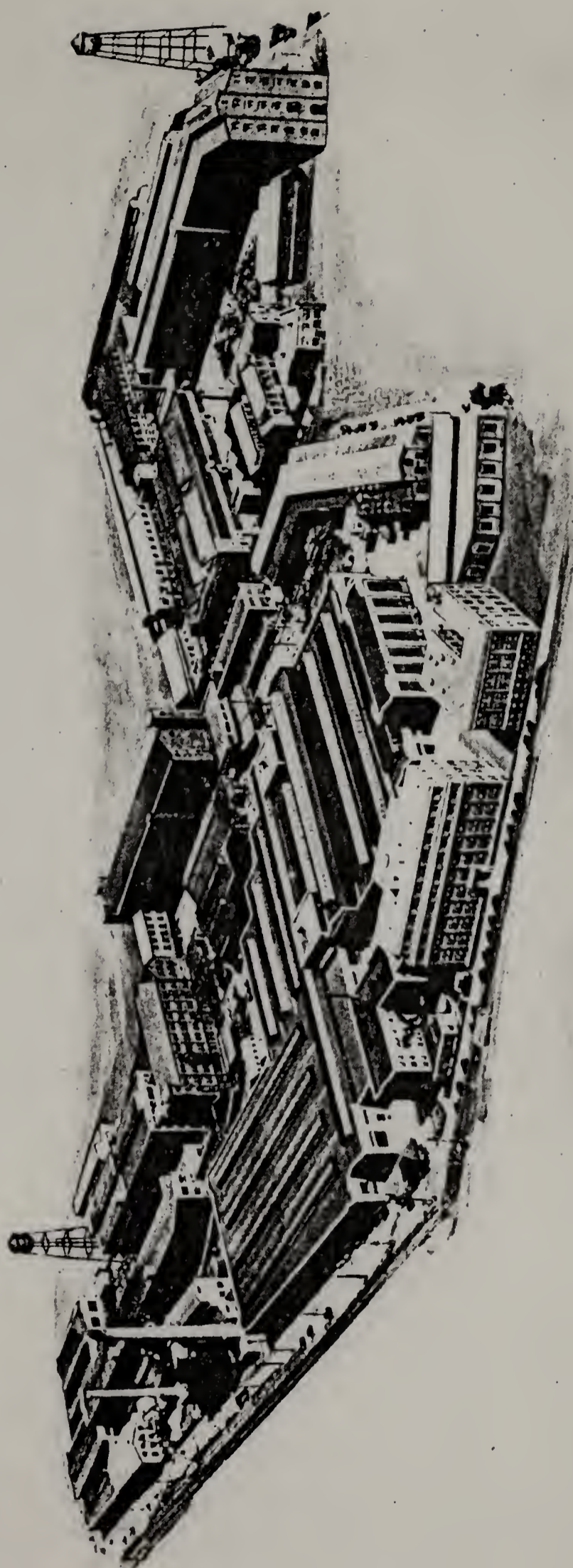
CHAPTER XVIII

AN INSIDE VIEW OF A GREAT INDUSTRY

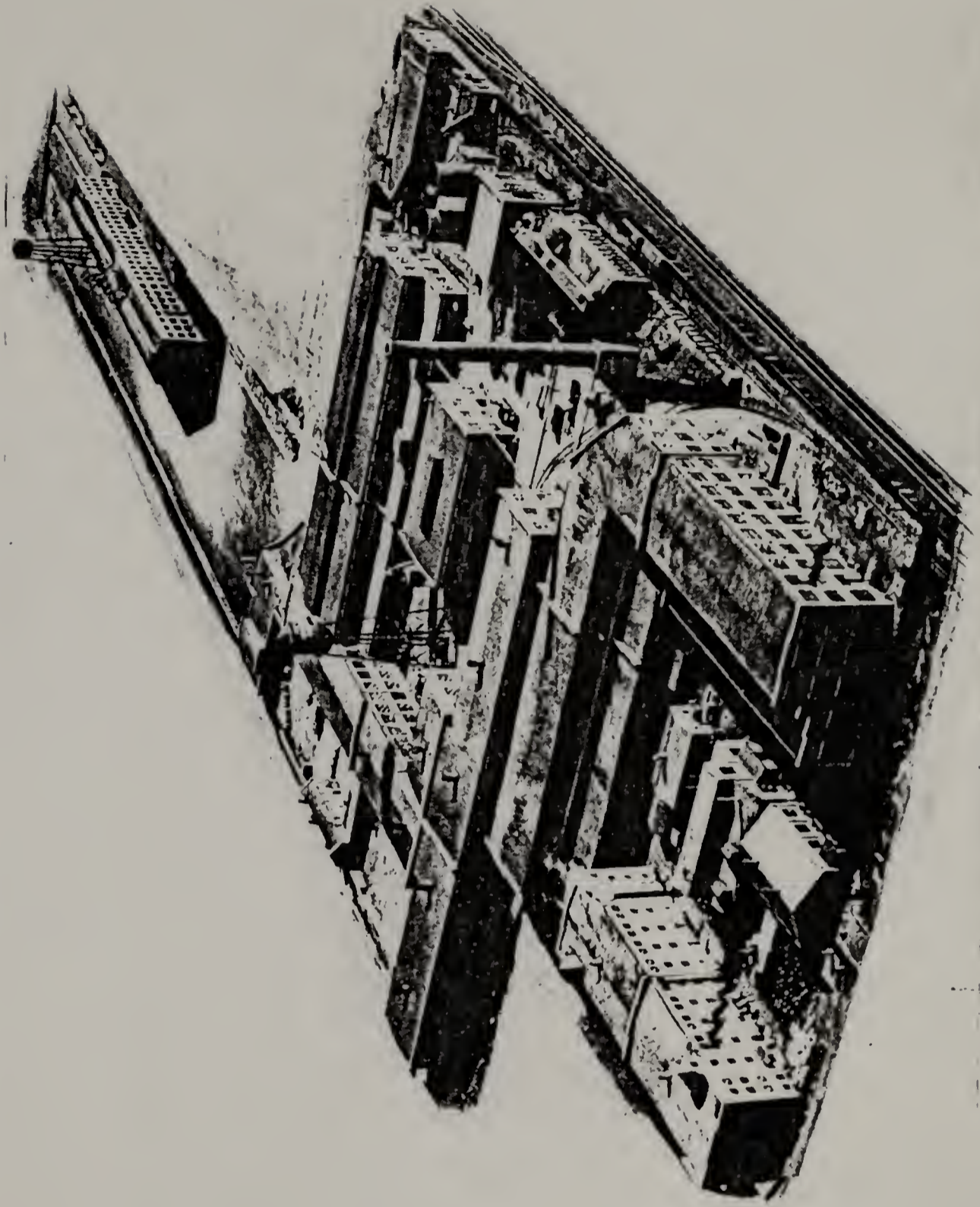
By WASHINGTON A. ROEBLING

A HITHERTO unpublished manuscript from the pen of Colonel Washington A. Roebling, prepared in 1919, following the lamented death of his brother Charles, and largely concerned with his achievements as a master-builder and engineer, has fortunately come into the hands of the author. It is a narrative such as could have proceeded only from one who possessed the most intimate personal knowledge of all the details pertaining to the career of a dearly loved brother and associate, and is marked by a discriminating judgment of a character of singular merit and genius, and yet withal compounded of many strange contradictions and anomalies. It presents a fascinating study of an energetic personality and is penetrated by a subdued pathos, highly honorable to its author.

Furthermore, and of supreme importance to this book, the memoir includes an extended survey of the development of a great industry, covering a period of over sixty years, with special reference to the part which Charles G. Roebling played in it. The difficulties and discouragements, engineering and mechanical, are clearly outlined and incidentally many shrewd observations are offered by the author on the events which he narrates. Altogether the memoir presents a vivid picture of business experiences, both profitable and otherwise, and all grouped about the activities of the person with whom he was concerned to deal.



The "Upper Works" and Main Office of the John A. Roebling's Sons Company, Trenton, New Jersey



The "Lower Works," or Buckthorn Plant, of the Roebling Company, Trenton, New Jersey

AN INSIDE VIEW OF A GREAT INDUSTRY

Like other of the Colonel's writings these reminiscences were probably never directly designed for publication, but were written primarily to occupy his leisure hours and to express, for his own satisfaction, the memories which he cherished.

The memoir as a whole is so essential to the object of this book that no apology is required for reproducing it in its entirety. If there is some overlapping with the course of events as elsewhere related, it is felt this will in no way detract from the value of these personal reminiscences, which for their characteristic style alone, aside from the wealth of information they impart, are well worth publication in full.

The present chapter covers a period in the affairs of the Roebling Company of about thirty years, extending roughly from the death of John A. Roebling in 1869 to the dawn of the twentieth century.

No one not intimately conversant with all the ramifications of a big industry could possibly have made such an illuminating contribution to its history. The Colonel's memory, even for minor details, is astonishing, while his shrewd running comments and observations upon the character and motives of his two brothers and of those associated with them in the conduct of the enterprise are not the least valuable portion. Perhaps the general reader may find some of the technical descriptions irksome, but to those who are engaged in the steel industry, and especially to the mechanical engineer, confronted by similar problems, the record will be regarded as a contribution of great practical value. Doubtless it was written without a reference, for, as the Colonel replied when he was once asked how he was able in his 80's to take up again the management of a complicated manufacturing industry, "I have been familiar with the business for sixty years and I carry all the information in my head." This would appear to be no idle boast.

THE ROEBLINGS

AN ILLUMINATING ACCOUNT OF THE INDUSTRY

BY WASHINGTON ROEBLING

When Charles came into the business in 1871 he found Charles Swan, my father's old superintendent, in charge. . . . Even before Swan left, the necessity of a new rolling mill had become apparent. The old one was antiquated, had a limited output and was adapted for small Swedish bars. The site selected for the new one was near Clinton Street where the present annealers are. New ground was bought and old houses torn down. Great improvements were effected in this new mill through the introduction of automatic return passes, saving several men and shortening the time of transit of the rod through the train, so that it was still hot when arriving at the last pass. Boys were used to take care of the long loops on the level floor. The use of an inclined slope was not thought of until years later and was then patented by another man.

At this time a galvanizing train was put in operation next to the old rope shop, where a great amount of experimenting and poor galvanizing was done. It takes time to grasp the full requirements of any new operation. There was the use of hot tubes to heat the wire and burn off the grease, the quality and quantity of muriatic acid, the washing off of the acid, the kind of pan needed to hold the melted spelter, the heat, the quality of spelter—most important—the best speed, the train of spools or reels for winding up the galvanized wire, the greatest number of wires to run through at once, the wiping when needed, how to avoid lumps and blackspots, and above all how to put on a coat of zinc which would not crack off when the wire was bent, how to prepare the wire, the protection against excessive oxidation, the handling of the dross and skimmings, how to handle heavy wire and fine wire, etc., etc.

AN INSIDE VIEW OF A GREAT INDUSTRY

There were at least fifty difficulties to be solved satisfactorily, else the business would not pay.

This was the sort of schooling Charles had to go through, day after day from year to year. Even today, when we rank among the best galvanizers in the world, questions will still come up. Usually defective cleaning of the wires is the cause.

A HUGE DEMAND FOR TELEGRAPH WIRE

The telegraphs of the country were assuming enormous proportions, expanding daily. We could not supply the demand. Thousands and thousands of tons were demanded to cover the United States. Our output grew until it exceeded that of the famous Washburn mills in Worcester. Ferdinand was especially active in expanding this part of the business and was very successful. Too often great orders were filled and stock in new companies accepted in place of cash. This sort of gamble often resulted in heavy losses, running up into the hundred thousands.

A change in the tariff cut us off from importing foreign rods for telegraph. There was nothing to do but make our own blooms from foreign pig, domestic scrap and Jersey charcoal. Charles arranged these works in short order, putting in a heavy steam-hammer and a number of small reducing fires. This worked with Swedish workmen for four years, when another change in the tariff caused its abandonment.

The small galvanizing shop having proved insufficient, a large one was built on the site occupied by the present tinning shop. It held six or seven trains, working day and night and Sundays, and still unequal to the demand. Our wire drawing capacity having proved too small, Charles became ambitious and planned a large five-story mill on Elmer Street, to be equipped on Worcester lines and superintended by a Worcester

THE ROEBLINGS

man, Cunningham. Hildenbrand, my former bridge assistant, helped to draw the plans. Property had to be bought and part of Clark Street was vacated. This mill was a wonder and a success. Of course, it brought with it an increase in annealing and cleaning house facilities. Some of the wire blocks in the old mill were moved over, giving us the room now used for storage of telegraph wire.

Previous to this some Yankee had invented a mechanical binder for binding wheat sheaves in the wheat field, thus supplanting hand labor. This opened a vista for untold quantities of binder wire. To make this, two of the upper floors of the old wire mill enlargement, opposite the present office, were fitted with fine wire blocks, and worked successfully for several years. Then it developed that ends and scraps of the wire got mixed in with the wheat and ground into the flour, thus not only killing people, but the fine wire trade, as well. We were then confronted with the problem of what to do with the fine wire output.

THE WIRE-CLOTH BUSINESS

I think it was Ferdinand who urged our going into the wire-cloth business. As we knew nothing whatsoever about it, it was necessary to find someone who did. This man proved to be a Mr. Orr, who had been foreman in a wire-cloth factory at Clinton, Massachusetts. He had also made some patented improvements in a loom, plans for which he brought. The New Jersey Wire-Cloth Company was now chartered, Mr. Orr to receive a salary and one-eighth of the stock of the company.

Charles, as usual, put up the necessary buildings on the east side of Clinton Street, our first invasion of that territory. The looms were built in contract, steam engine and boilers provided, and the business started.

AN INSIDE VIEW OF A GREAT INDUSTRY

Every new branch of business was always a pet for several years, until the novelty wore off, and the initial profits, which were large, had become reduced by competition and by the unfortunate fact that jobbers really controlled the profits. As time went along we consoled ourselves with the delusion that the wire-cloth business must be continued in order to consume the extra output of the wire mills. We had one good outlet for cloth in our California store. The handling of this business proved a heavy burden on Ferdinand's shoulders, and when his brother-in-law, F. O. Briggs, came to the office it was soon unloaded on to him, to F. W.'s great relief. As earnings, owing to competition, are soon reduced to unprofitable basis it is necessary to go into some new line of business, because it is only in the first few years that large profits are possible. But it does not always follow that a new departure is a success. Our entrance into the wire-nail business is an example of it. This was abandoned, not because it was intrinsically bad, but because it was necessary to make it one's principal line of production and arrange the entire plant with a view towards that one focus. It was intended as a side-show, and died as such. Nail-making was replaced by machines for flattening wire. This business assumed large proportions.

THE ERA OF BESSEMER STEEL ARRIVES

New projects and new developments kept crowding in. Charles and Ferdinand were busy day and night, year in and year out, to keep up with them. The era of Bessemer steel had arrived in the early 'seventies and was gradually taking the place of the costly Swedish iron and American charcoal iron.

The treatment of this material cost Charles many an anxious hour and years of experimenting. One of his most striking characteristics was that he wanted to do everything and find out

THE ROEBLINGS

everything himself. That disposition has great merits with a few demerits, because sometimes it is much cheaper to buy what you want than to waste thousands in experimenting. This tendency of self-reliance was one of Charles' chief points. It strengthened his capacity for successful work and enabled him in later years, when he was in his prime, to undertake great projects where he had no precedents and was forced to rely upon himself alone. This period in a busy man's life lasts only a few years. The time inevitably arrives when it is necessary to train someone else to take your place. With him that time never came, simply because he could not tolerate the idea of raising up an equal. Perhaps he died too soon. But the constant arguments that took place between him and Ferdinand had their root in that trait. On the other hand, it is a great thing to have a man at the manufacturing head in whose infallibility every subordinate had the most profound confidence.

DEALING WITH STRIKERS

As the employer of labor it was Charles' duty to fix wages and settle strikes when they came, a most difficult task, because it is necessary to be just to both sides.

For many years we had nothing but Germans in our employ, a peaceful and tractable race. The number of operatives was comparatively small so that most everyone was known by sight or name. This could not last. Wire-drawing, a special trade, was gradually monopolized by Englishmen. About 1875 our Worcester competitors established a saving in the costly wire-drawing plates, by substituting for the larger-sized holes a cheap chilled cast-iron die which could be reamed to guage by a few men, the mere drawing of the wire and taking it off the block could then be done by ordinary labor. The high wages of wire-drawers had been due to the skill needed in set-

AN INSIDE VIEW OF A GREAT INDUSTRY

ting up the holes, hammering the conical hole into shape and tempering the plate. When this went into effect every Englishman, about fifty in number, struck and refused to use chilled dies. They sat around on the fence for a couple of days, and then left, most of them going to Cleveland. Not one ever returned. This was the first serious strike. Charles was a *good fighter*. When he felt he was right he would not give in. This was the forerunner of many a subsequent strike, especially when he began to employ many different nationalities—Italians, Poles, Hungarians, Scandinavians, Croats, Russians, Roumanians, Greeks, etc. The hardest test comes when it is imperative to reduce wages in hard times. It requires courage then to face a band of infuriated men. Charles possessed that courage in the highest degree.

The point I wish to make is that this kind of work has a tendency to harden a man's character; he becomes brusque, suspicious, and this in a way tinges his intercourse with others that he comes in contact with. Life's crucible hardens many a heart, and one has to make allowances in judging character.

On one occasion a band of two hundred murderous Italians, armed with knives, made a raid through the mill, driving everyone out. Few men would face such a demonstration with a stout heart, but he did.

But to resume chronology—

Bessemer steel wire was now used for ropes. The product was unsatisfactory, brittle and cracky, maximum strength 160,000 per square inch. To galvanize it was a tough job. The largest contract for that material was with the Brooklyn Bridge, for footbridge cables, and later for stays and suspenders. Charles was very busy on that. In connection with it we found out how to temper galvanized wire straight (it did it

THE ROEBLINGS

itself) and avoid running the wire through heddles or straightening machines. Colonel Paine got a patent on it.

With every year the business horizon expanded.

WIRE ROPE FOR CABLE ROADS

A prosperous period for rope-making had now arrived, namely, making long ropes for cable roads. This surpassed all expectations, so much so that Charles had to start another wire rope shop alongside the old one, and build especially another big rope machine which could lay up 30,000 feet of 1½-inch diameter common lay and long lay, all of which he designed and executed in 1893, and none too soon. For a while we had all the cable road business to ourselves, but could scarcely handle it all, which brought on competition. While the roads were new the ropes lasted, then there came complaints, and finally the ruinous system of guaranteeing a certain mileage was forced on us. On top of that the roads insisted on our taking stock in pay. This entailed heavy losses on us, when so many roads went into bankruptcy, thereby neutralizing previous profits—Broadway, for example.

Constant additions of machinery and strand machines were being made to the new rope shop. In a year or two it was full. The strand machines were mostly the old type and running quite slow with a moderate output. It was slow work to make strand for the small-sized elevator ropes, for which the demand was steadily increasing.

The idea of making small-sized strand on fast-running horizontal Smith machines had not yet crystallized into the vast expansion it reached later on. In designing these machines Charles did his own work, making all the drawings himself, besides attending to all the work in the shops. His industry was indefatigable. Much trouble was experienced with the last

AN INSIDE VIEW OF A GREAT INDUSTRY

new vertical rope-laying machine, built in 1885, which exerted a pressure of forty to fifty tons on the washers in the bottom step, causing frequent heating from friction and a stoppage. This was finally overcome by using a pump which forced oil all the time into the washers. The largest machine of all he built in 1893.

About this time, 1900, we purchased the adjacent property on the canal front called the "Saw Works," where had been made circular saws with inserted teeth. Connected with it was a small outfit of drop hammers which we transferred to the new machine shop and have found very useful in forging wire rope sockets cheaply and strong. This goes on steadily.

Besides attending to strictly shop matters Charles attended to much outside engineering work connected with our business. For example, the systems of underground rope hauling assumed large proportions. Mr. Hildenbrand, who was released from Brooklyn Bridge work, collected facts and data described in a voluminous pamphlet. For a number of years this was a good business until gradually replaced by electric haulage later on.

Hildenbrand helped Charles in designing the new wire mills, making plans for small suspension bridges and many smaller contrivances. Wire-rope tramways were a tempting outlay of time and ingenuity, almost more trouble than it was worth.

Charles really did not have time to devote his best work on them, so it was left to assistants, who were better in promises than performances. One rascal cheated us badly. A competitor made some headway with the Bleichert Tramway. They do not last long, are temporary and a makeshift, and when it comes to guaranteeing a certain output it becomes a losing proposition. The manufacture of big ropes for a permanent cableway is a much better proposition. An active, prosperous,

THE ROEBLINGS

paying business is a source of great excitement. Almost daily new propositions come up to be considered as to their merits. In course of years the judgment becomes cultivated. Ferdinand was a great pusher, but it was Charles who had to do the actual work of creating the realities. It was impossible to take up every new thing. One outside enterprise, besides some others entered into, was the manufacture of a poor variant of regular barb fence, made of flat strip cut with saw-tooth edges. Ground was bought below us on the canal, a one-story building provided with fifty to one hundred edge-notching machines. For a couple of years it made money under Kelsey's [Henry C. Kelsey, a prominent citizen of Trenton and for many years Secretary of State] management (the John A. Roebling's Sons Company furnishing the raw strip)—it could not compete with ordinary barb fence, gradually dying out. The grounds and remains of plant were finally bought by the John A. Roebling's Sons Company, and now forms the site of the last rope shop, our most valuable asset.

THE AGE OF ELECTRICITY—INSULATED WIRE

The electrical age had begun; everything was to be done electrically—lighting, communication, power lines and the hundreds of other appliances connected with it. All this meant copper wire, large and small, in untold quantities, not only bare but also insulated. We had never drawn or rolled copper wire; it was a new problem which Charles, of course, had to solve, and as usual he succeeded after some failures. Our rolling mill passes had to be adapted; we had to learn how to heat it properly. Then came the annealing and quenching in water, the drawing of the wire which was easy in large sizes, but had to be done through jewels in the fine sizes, the danger of overheating which oxidized the copper, and finally the invention

AN INSIDE VIEW OF A GREAT INDUSTRY

and use of regular wire-drawing machines where one man could run a bench of six or eight reductions in size. Fortunately this did not have to be all invented in Trenton, because outsiders had already begun to make wire-drawing machines.

The copper business is entirely different from steel wire. Being three times as dear it takes three times the capital to swing it. For an unknown reason the profits per pound were very low, only a quarter of a cent for the larger sizes. It was higher for fine sizes, but the quantity was less. In executing contracts for telegraph companies you ran the risk of having to take stock. It therefore became a job of buying as cheap as possible, and secondly of insulating the wire, and thereby getting a little more profit out of it. The first braiding shop was a one-story frame building put up on the site where the large insulating shop is now. Braiders could already be bought and the other appliances were few at the beginning. Neither was much capital needed because the copper wire came theoretically from the mill. The methods of insulation were many, some patented. First came ordinary braiding with cotton yarns; later paper insulation was largely used, which brought no end of a law suit. Since the object of this article is to a large extent the history of Charles G. Roebling I am free to say that he never fully approved of it. It was a side-show attended with much bother and trouble; it was never very profitable, even at first when it usually pays, and in many years this business showed a considerable deficit. Taken as a whole, including the fire losses, I do not think it has ever paid. It was looked upon as an outlet for our increasing output of copper wire. As was to be expected, this shop burnt down one summer in half an hour, in 1892. Then came the question, shall we rebuild? Ferdinand was so insistent that Charles yielded, and a greater braiding shop was put up by him; in fact when very heavy

THE ROEBLINGS

wire was being braided for power conductors and electric lights an extra small shop was put up behind the galvanizing shop. This was also destroyed by fire later on. All this sort of business goes on today, only on a tenfold scale.

The whole manufacturing world was going mad about electricity. At an early period Ferdinand was fascinated by the magnet-wire business, affording an outlet for very fine copper wire covered with green and other shades of high-priced silk thread—it was a delicate, nice, clean business. After some trouble a mechanic was found to build one machine; this was improved upon, then others were invented and acquired. This was a successful venture, much to the credit of F. W., who deserves it. It runs to this day, although replaced to a large extent by enamelled wire, which we are also making at a profit and is a business that could be largely extended, located at the Buckthorn works.

A LOSING VENTURE

About this time, 1887, a man appeared on the horizon, a promoter of the flattering sort. F. W. was very much taken with the prospects of the incandescent light business. This promoter pretended to own a patent fiber and to have on option an Englishman who would come over and run a factory. Charles positively refused to go into the combination, where he showed his good sense. I was dragged into it unwillingly and before I got through with it I had lost \$75,000. A small old factory was secured in Newark. The Englishman who came proved to be a drunken palsied paralytic with two mistresses, who came along. Of course, suits were filed for infringement. The film being a carbonized thread, the promoter went to work to make bulbs and lights. It was not a success in spite of his fake reports of great success. The four other stockholders quit

AN INSIDE VIEW OF A GREAT INDUSTRY

and the thing gradually died, taking years to wind up. F. W. lost more than I did. In addition he had this promoter on his hands. He started in on a salary to promote electric roads, mostly for stock, more loss than gain. Fortunately after some years he died. This was one of the many ventures that did not succeed. It is not all velvet in any business. The general insulated wire business, however, received much attention; two very large additional buildings were put up and gradually filled with machinery, about 1898. This went pretty well for a couple of years, when the fashion changed to a rubber insulation. To hold our trade we had to go into the rubber business. This was something new for Charles, but he managed it, put up splendid large machinery in a new shop at great cost and slowly learned the business as it is today. This business also expanded into side-lines, and finally arrived at its present state of perfection, with small profits and sometimes none.

AN ERA OF BUILDING SETS IN

In 1896 Charles was preparing one of his tours de force, namely, a new rod-rolling mill to be located on the east side of Clinton Street where the additional ground had been bought.

Great advances had taken place in rod mills. A competitive mill had just been built which could roll three and four rods at a time as small as No. 5 gauge, and having an output three or four times that of our old mill. The main driving power in the old mill had been a huge cogwheel, 22 feet in diameter, provided with wooden cogs. This sufficed for soft iron, but would not answer for harder steels.

Charles tackled the problem with his usual zeal. To do it all with one engine was out of the question. He divided the system into three parts, one engine to drive the heavy rolls for breaking down billets, direct acting—an old engine was used for

THE ROEBLINGS

that. The rod train proper was divided into two parts, each with its engine. A new principle was adopted. All former heavy gearing was replaced by huge, wide, fast-running belts, $2\frac{1}{2}$ feet wide and three-ply, thus avoiding all shock; intermediate heavy passes were provided for by intermediate belting. The big belt pulley was the flywheel at the same time. The inclined plane was adopted for taking care of the slack (patented). Powerful Porter-Allen engines were installed to drive the train, two automatic double semi-circles for returning the rods were used on one side, saving four men. Charles devised a new reeling-up apparatus of four circular revolving tables, self-discharging, all operated by one man. A vertical arrangement of this sort had failed. Other people used a patented revolving goose-neck, very simple, which could not be had. All minor difficulties were finally overcome. The train proved a great success and is now running. Such a train requires many accessories: a great battery of steam boilers, with a railroad in front to supply coal direct. City water was dear, so a huge well was dug, 35 feet in diameter by 30 feet deep, supplying most of the water for heating and cooling (another such well 800 feet away proved dry); ashes had to be disposed of. For the first time on the place the Siemens gas-heating brick complexes were used to heat the coal gas supplied to the heating furnaces from the gas generators—all difficult work—then came conveyors, roll-turning shops, new kinds of guides, arrangements to dispose of the products as well as to bring the billets there. Not everything can be thought out in advance; usually something has to be perfected by intelligent experiment. After running a few years some Swede invented a new heating furnace in which the entire charge was constantly pushed ahead by a hydraulic ram, saving much labor. Charles built it. Of course, a strike followed. The workman so often acts contrary to his real

AN INSIDE VIEW OF A GREAT INDUSTRY

interest, because every improvement like this increases the output and improves the quality and gives him more work in the end.

An enterprise like this new rolling mill requires at least a year and a half from its first inception until its final completion, and it came out of the brain of one man, and that man was Charles G. Roebling. In 1900 the rolling-mill engines were shifted, a larger one being put in the center so as to enable us to roll hard steel, for which there had not been enough power. It was done in less than two months.

Through a remarkable train of queer circumstances this mill was practically destroyed by fire some fifteen years later. A hot rod managed to find its way into the flywheel pit of one of the big engines, setting fire to a lot of grease and oil which the wheel scattered all over, and at the same time the rod became entangled in the wheel and was thrown up against the roof, setting fire to it *instantaneously*. The biggest loss was in the belts and a cracked flywheel, or big belt pulley. In six weeks everything was running again. One man died from fright.

HARD TIMES AND STRIKES

There were a couple of years of hard times now; wages had to be reduced, followed by the usual strike which had to be settled by Charles. I was present when he addressed the rolling-mill men, and certainly did not envy him the task. When there is much of this a man's temper becomes hardened; there is no help for it, you have to face the music. As usual he was the only man to do it. The old abandoned rolling mill was now junk, which means that much lost or wasted, and casts a heavy debit into the balance sheet.

Charles' first attempts at lead tempering had provided better results than subsequent ones. Why, no one knows. A large

THE ROEBLINGS

lead pan to do the heating, then a short air space to do a little cooling and then a small pan to draw the temper. C. G. always inclined to air tempering, which is now being used almost exclusively. About 1888 Bessemer steel was being replaced by open-hearth steel. Most of our fine steel rods for wire rope were imported from Sheffield. Iron rods for extra B. B. telegraph wire came from Sweden and steel billets had to be bought in this country, and even abroad, wherever we could get them. We were beginning to feel that we were laboring under a great handicap because we could not produce our own steel.

AN ERA OF BUSINESS EXPANSION BEGINS

The commercial end of the business usually outstripped the other. We had our stores in San Francisco, in New York and Chicago and elsewhere; agents all over. Our man Shippy had become a globe-trotter. Cable ropes in quantity went to Australia and elsewhere. Expansion was the order of the day. Every branch of the business was run at top notch. But it was not all profit. Heavy losses at times would neutralize the profits of half a year. From 1897 to 1900 was really a period of depression which ended with our victory in the Spanish War. Then came good times; all kinds of juggling were resorted to to keep the place a-going and supplied with work. Then is the time one suffers from over-expansion. But it is also the time when everything is cheap and therefore the time for laying the foundation for future expansion. For a while losses in the copper trade overbalanced any profit, and we are not through with it to this day (1919).

In 1898 to 1900 the removal of the old rolling-mill made available a large piece of open ground, corner of Clinton and Elmer Streets. The temptation to build another large wire mill on this site proved irresistible; in fact it was needed. Charles

AN INSIDE VIEW OF A GREAT INDUSTRY

went at it with his usual vigor. The building was about 40 per cent larger than the Elmer Street mill, being considerably longer and somewhat wider. An engine of double the power of the other was designed for the southern end, a new series of boilers installed close by. Hildenbrand assisted in getting out the plan of the building, which was provided with two elevators. As usual, the most difficult part of such a problem is the transmission of power by means of belts to the various floors. The stories being of average height, these vertical belts had to be short and worked under great tension to do their work, and this is not economical. This was not fully recognized and led to an entirely different plan at Kinkora (now Roeb-ling) when those great wire mills were designed, and where there was ample room to put everything on one floor. In a five-story mill the capacity of the elevators measures the capacity of the mill. The greatest danger in these tall buildings is that of fire. If it once starts there is no hope; both of these wire mills must go, especially as they are connected—Clinton Street wire mill built in 1899. Charles always turned up his nose at any suggestion about protection against fire, but our two large fires gave him a jolt which he did not forget until his dying day. The worth of the new sprinkling systems remains to be proved.

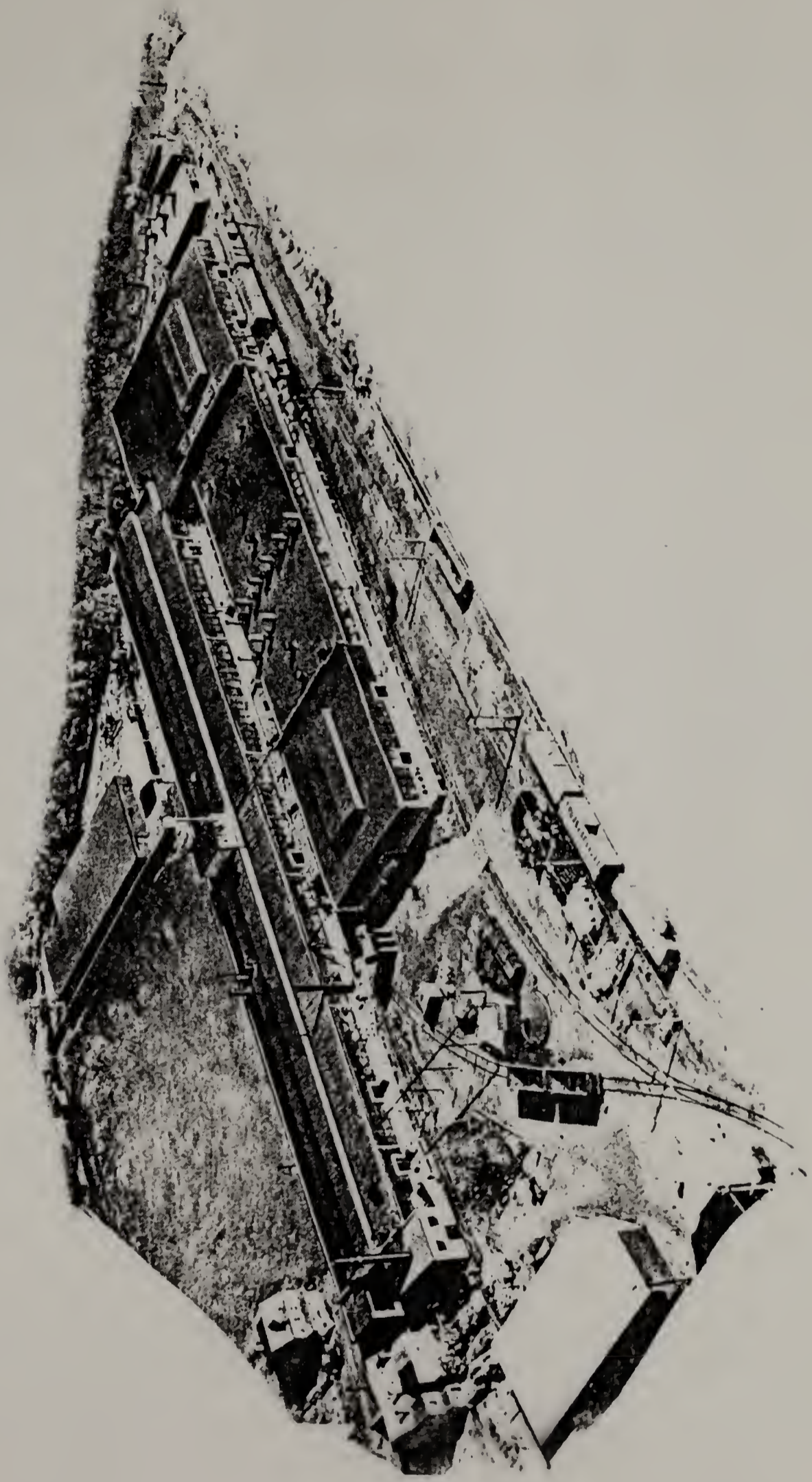
A few years previous we had bought from Charles Carr the property facing the canal and extending from the Saw Works to Mackenzie's foundry, with the ultimate idea of building another wire-rope shop there. That time had arrived. The demand for small-sized elevator rope had become so great that we could no longer devote the slow and cumbrous machines in the old shop to do this work profitably. Charles proceeded to erect a long two-story building, nearly 600 feet long with a short extension on the canal side for cable work and galvanized strand. Many small-sized upright 19-wire strand machines were put in; also

THE ROEBLINGS

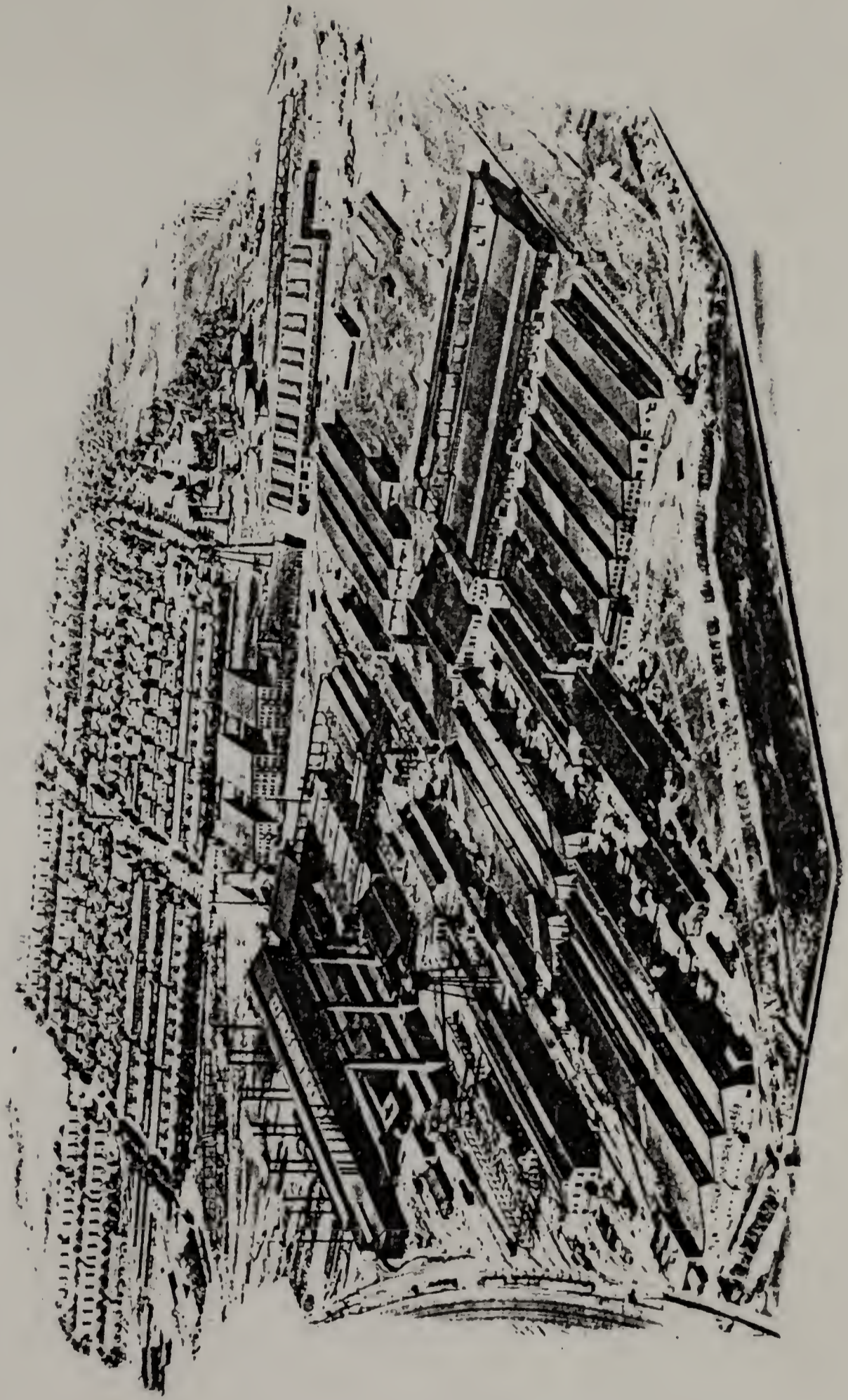
a number of horizontal machines for 19-wire strands, together with a suitable number of rope-laying machines, not to forget very small fast-running machines for Tiller rope strand. All of this machinery was built on the place and had to be designed and properly proportioned in Charles' office. A carpenter shop was built on the same lot and a coal yard established. The boiler house was provided with automatic stokers—first on the place. After running most successfully for less than ten years the building with all its valuable contents was totally destroyed by fire one bitter cold night, zero weather and heavy snow. It started as usual between shifts when no one was there. No one knew how it originated. This was in February 1908.

THE FIRST OF MANY GREAT FIRES

This was the first *great* fire we had on the place and was a great blow to us all, especially Charles. He saw the work of several years swept away in a few hours; he realized the heavy monetary loss, and more than that the prospective loss of business. Added to this came the thought of all the work ahead to put up a new building and replace all the machinery. Much rope was made for us outside. This was the first of three or four really great fires that devastated our plant later on. Fortunately, there was much rope machinery available in the I.W.D. [Insulated Wire Department] and Buckthorn plants. Working day and night and Sundays in all shops helped wonderfully. The old shop was untouched.



The Electro-Galvanizing Plant of the Roebling Company, Trenton, New Jersey



The Plant and Village at Roebling, New Jersey

CHAPTER XIX

AN INSIDE VIEW OF A GREAT INDUSTRY

(Continued)

By WASHINGTON A. ROEBLING

THE WILLIAMSBURG BRIDGE CABLES

IN DECEMBER 1899 the contract for building the four cables of the Williamsburg Suspension Bridge was let to the John A. Roebling's Sons Company of New York for the sum of \$1,389,000, to be finished in ten months. Mr. L. L. Buck was engineer of the bridge and had prepared the specifications. All the work on this bridge was done by contract, nothing by day's work—just the reverse of the old Brooklyn Bridge. Charles Roebling's ambition was fired; he was determined to build them. They were more than twice the size of the Brooklyn Bridge cables; consequently the honor would be twice as great.

Charles Roebling had a double task, namely, to build the cables and also make the wire—a big job in itself. After the contract was let Mr. Buck left for Europe, where he spent over a year. On his return they were nearly done. Before the contract was signed the authorities in New York demanded that I should look a little after the work because Charles had not built large cables before and I had. This was simply precautionary. Charles did all the real hard work. As an assistant he had William Hildenbrand, who had been my assistant on the cable work on the Brooklyn Bridge, and was familiar with the vital points. Owing to Charles' disposition I occupied a delicate position, but an occasional hint to Hildenbrand was sufficient.

THE ROEBLINGS

One of the first things to decide was this: Mr. Buck had prescribed that the land spans of the cables should be laid in a straight line, resting on an enormously high trestle work, the object being to avoid the excessive saddle movement of seven feet, there being no load on the land spans. The objection to this was the great cost and trouble of putting up such a trestle, and the great danger from fire which would ruin the cables. Moreover, it would be impossible to regulate the tension of the wires in the main span properly without a counterbalancing tension in the land spans. Mr. Buck, being away, had left everything to the Roeblings. I succeeded in convincing Charles that my view was correct. The trestle was abandoned, the saddles moved all right, and perfect cables were the result. Hurrah!

Charles attacked every problem with his usual energy. On the Brooklyn Bridge the footbridge cables had been taken over on small carrier cables, so as not to interfere with navigation, ferryboats being very thick there. But here vessels were much fewer and Charles successfully adopted the plan of placing all four cable reels at once on one barge, towing that across and letting all the ropes pay off into the water at once, and then raising them to their place afterwards. The only thing I did not approve of were the excessively heavy *temporary* wooden footbridges. Three or four times as much timber was put in them as was necessary. I partly blame Hildenbrand for this.

The experience on the Brooklyn Bridge had been of great value. The wires in these cables were made of No. 6 steel wire, over a size larger, strength 190,000 pounds per square inch. The wire was tempered straight. Consequently the strands did not have to be made under high tension to take out the kinks and bends. The strands were laid only a short distance above the main cables, thereby reducing the strain on them, shorten-

AN INSIDE VIEW OF A GREAT INDUSTRY

ing the leg, and enabling quick release by using long jacks. Thus the danger of letting off high tension strands was largely eliminated. Since the Roeblings also made the wire it became possible to splice the wire together in long lengths and wind it up on wooden reels at Trenton, which were sent to the anchorages and returned empty, thus reducing the splicing of wire on the anchorages to a minimum. The next great improvement consisted in transporting wires across double; he invented a double wheel; that is, the travelling wheel carried wires both in going over and in coming back, thereby reducing the time of cable-making over a third. (Even this was improved on by one Robinson who had been cable inspector on part of the city. He divided each cable into two separate halves, laying wires into each half, thereby reducing the time of cable-making another third, on the Manhattan Bridge.)

On the Brooklyn Bridge I had to design my own machinery, but the art of making portable hoisting or pulling engines and drums had so advanced that the Otis Elevator Company quickly devised the necessary machinery, under Charles' direction, adequate to pull over all the wires both ways.

Cable-making itself did not take seven months. The packing of the nineteen strands was properly done; they were clamped and the suspender saddles of cast-iron put on. The engineer, perhaps because the Brooklyn Bridge cables were made of galvanized wire, had ordered the wire to be merely oiled. This was a great mistake. Similarly he deprecated the beautiful wrapping which makes the cables look like solid cylinders. Sheet steel covers were put on instead, but afterwards they were taken off and the cables wrapped between the suspenders. After the cables were finished a fire broke out on top of one tower. The footbridges were destroyed from end to end, and one cable quite seriously damaged. This was a terrible blow to

THE ROEBLINGS

Charles. On inspection by a committee it was found feasible to cut out the burnt wires and replace them. But the foot-bridges had to be rebuilt in order to put on the suspenders and cover the cables. The wire was made in Trenton and oiled in a building corner of Mott and Clinton Streets. . . . Charles never wrote an account of these cables. I have taken this occasion to do so.

THE UNITED STATES STEEL CORPORATION MAKES AN OFFER TO THE ROEBLINGS

In 1898 the United States Steel began its career by buying up all the cheap steel properties that were lying around for sale on account of the hard times. Mr. Gates was always the go-between. They made us an offer and Ferdinand insisted on taking it; even Charles favored it. But I am free to say that I violently opposed it, and the deal did not go through.

THE ROEBLING CONSTRUCTION COMPANY

Another proposition which I unfortunately could not frustrate was the formation of the Roebling Construction Company. Mr. Orr, the superintendent of the New Jersey Wire Cloth Company, anxious to retrieve the low price of cloth and chicken netting, had introduced the use of stiffened wire lathing for fireproof partitions and walls—a very good thing. This was the new era of fireproof buildings. In addition he proposed concrete floors stiffened by reinforcing with round rods, all in panels put together in the shop, ready for use. This was all very well in a small way and brought in some business for several years. Then the idea was broached, why not take the contract for the entire building and get the profit of the middle man? Now this was an entirely different proposition; it was the tail wagging the dog; it meant taking risky contracts of \$500,000 to \$1,000,000 for the sake of a few thousands of

AN INSIDE VIEW OF A GREAT INDUSTRY

profit to the New Jersey Wire Cloth Company. Both F.W. and C.G. were hot for it. I was reproved as one opposing all progress and expansion. My point was that such a large and intricate business would require the constant attention, every day, of both F.W. and C.G. to make it any kind of a success; that the buildings were scattered all over the country and the work had to be entirely left to subordinates. Well, I was overruled. For a year it went poorly. Then the office management was left to F. O. Briggs and the actual building to Himmelwright. No year showed any profit, losses accumulated; fifty or a hundred thousand was nothing. After seventeen years Charles fortunately got mad one day and wound up the company. A deficit of one million and a half was charged off by the John A. Roebling's Sons Company, to whom it was owing. This does not include many previous losses. I have always thought that our own legitimate business, which is thoroughly understood, afforded every avenue of expansion that the future might offer, and I still think so. No business can flourish unless it is to a large extent under one's personal supervision, and there is a limit even to that, as we are finding out in 1919.

In a large business all sorts of deals are made, many kinds of propositions are made and have to be considered. The best judgment sometimes goes astray because we are prompted too much by our greed or influenced by the fluttering moth of more orders in the future. The owner has one bugbear always confronting him, and that is he must keep his factory running as nearly full as possible, otherwise the vast number of outside and overhead expenses eat him up. One mistake has often been made: after a deal is completed for stock or bonds, at a profit, and the securities received, they are laid away and forgotten; you delude yourself with the belief that they will always be good until you wake up some morning and find that their

THE ROEBLINGS

value has disappeared overnight. The only cure is to sell the securities and put them into something solid. But there you run counter to all kinds of personal idiosyncrasies, the worst of which is the one that you think you are infallible and nothing can happen against your better judgment. Such minds, and there are many, are simply incurable. The saving of years begins to crumble away; you have not the energy to cut a loss, suddenly all is gone, and too often it represents the labor and worry of years. I do not mean to imply by any means that I was always on the right side.

A COSTLY FIRE

On January 18, 1915, the great calamity came. The entire Buckthorn works were destroyed by fire, absolutely—not a vestige left, and undoubtedly set on fire by an incendiary. The fire occurred between 6 and 7 in the evening when the men were away. The fire alarm was systematically cut so that fifteen minutes were lost waiting for fire engines. It started in a room where no work was being done, but there were quantities of cotton, jute, etc., stored there, all inflammable, and lastly a man was seen running away from the room. The fire burnt all night; there was so much to burn that the flames went sky high; the intense heat scorched the adjacent buildings; by morning nothing was left. The loss has been estimated at one and a half to two millions. The great stocks of copper were burnt and oxidized. The lead and tin melted and formed a solid floor of metal in the cellars. The machinery was all scrapped. The lead presses alone escaped damage. This was the era of advancing prices due to the war; hence the metal salvage was great.

Before deciding the question of rebuilding, the ruins had to be cleared off. That was a job, taking months. The oxyacety-

AN INSIDE VIEW OF A GREAT INDUSTRY

lene blowpipe showed its great worth. As usual the rebuilding came on Charles' shoulders, but he finally built on a reduced scale, putting up only two stories in place of three, which proved more than ample because we lost very much business. A great change was made in the driving power. For the first time Charles used the steam turbine in place of the steam engines in the building; electric drives with motors were applied throughout, doing away with expensive shafting and belting; more boilers were gradually put in, also three cooling towers. A large carpenter shop was built on the old site, where all the spools, reels and drumsides are made. The braiders were reduced in number and more attention paid to lead cables. Even at this day (January 1919) the rooms are not all utilized.

THE WORLD WAR CREATES A GREAT DEMAND FOR WIRE ROPE

Owing to the World War an enormous demand for rope had arisen, both domestic and from abroad, more than we could do. So Charles determined to build another rope shop opposite the Buckthorn building, when the latter had scarce been finished. Ground was bought, streets changed, the building laid out and foundations put in as quickly as possible, end of 1915. Owing to the lay of ground the building could not be straight, but made an angle. It took in the old chicken-netting factory, but did not disturb the enamelling shop, which is almost surrounded. Connected with it was a warehouse for rope and strand. It was winter before the brick work was finished. Increased power was provided, another turbine put in and more boilers. Scarcely was it finished when the second great calamity came to pass.

THE NEW WIRE ROPE SHOP BURNS DOWN

On November 11, 1915, the new rope shop on Elmer Street burnt down about 3 a.m. The fire started in the Clark Street

THE ROEBLINGS

annex, second story, where the large stocks of hemp centers were stored and tarred. As usual, the fire alarm wires were cut or out of order, causing the fatal delay. No foreman being about, there was only disorder. Owing to the long strike of the previous year we had many disaffected foreigners working in the shop, especially Austrians. The probability is that it was incendiary. The fire spread and spread. The imaginary fireproof construction of iron beams and brick arches was worse than useless. As the beams became red hot the whole construction collapsed. It is only by enveloping iron beams or posts in concrete that they become fireproof.

Soon the entire building was in flames and all the valuable machinery was doomed. About 160 machines were ruined, large and small. The upper stories of the Clark Street building were filled with wooden boxes; nothing could have saved that portion. It was only with the greatest difficulty that the Elmer Street wire mill was saved. Had that gone, Clinton Street mill would have gone, too. Photographs of the ruins depict indescribable masses of tangled beams, machinery, columns, wire and wire rope. The salvage was really nominal—just scrap; very few rope machines could be used again.

HUGE WAR-TIME DEMAND FOR WIRE PRODUCTS

The war demand for ropes, especially foreign, was so great that we were fairly overwhelmed with orders at high prices. A million dollars in prospective profits was gone!

This occurrence was another great shock to Charles, not so much the loss of nearly two millions, but the prospect of rebuilding that had to be done. But he went at it with surprising energy.

The new rope shop building at the Buckthorn was completed but had no machinery; that had to be made yet. Our

AN INSIDE VIEW OF A GREAT INDUSTRY

other rope shops, including the I.W.D., did what they could, working night and day and Sundays. Wire was rushed to several other factories. At Clinton, Massachusetts, Charles bought a whole rope factory; at Plainfield, New Jersey, a small one; he bought strand machines in Providence and Easton. Our own machine shop was rushed to death. Fortunately, the large Buckthorn building had four empty rooms with power; strand making began in them at once. Slowly, but by degrees, one machine after the other was added, but a full year elapsed before equilibrium was reached, even now we are many months behind on rope orders, but in nothing else.

The Elmer Street rope shop has also been rebuilt and is slowly filling up with machines. When this is done we will for the first time have a surplus of rope machinery. The Clark Street annex was of great use in Government work and the like—nets, harness, mines and so on. Most of the problems connected with Government work required brains to handle. The bulk of the great net (carrying mines) across the North Sea, 200 miles long, was made in our shops and assembled elsewhere. The making of artillery harness was something new. Wire rope and appliances for mine sweeping were also new. Great quantities of copper were manufactured.

FINE ROPE FOR AEROPLANES

The manufacture of fine rope for aeroplanes, guys and stays was conducted on a stupendous scale; an incredible quantity was manufactured—hundreds of millions of feet. The new rope shop at the Buckthorn was taxed to its utmost capacity night and day. At the close of the war much of the machinery stands idle. With this aircraft strand came the various fastenings that went with it, 50,000 pieces a week or more; all had to be thought out and contrived. We made the bulk of the large nets closing

THE ROEBLINGS

the principal harbors of the Atlantic coast, nets of great length, ranging from 50 to 400 feet in depth. For all of them special appliances had to be invented to make them rapidly and at a reasonable cost—all done in Charles' office.

I could fill pages with war-time activities, but must refrain—they have not all ceased yet.

THE FLAT-WIRE BUSINESS

Before proceeding to the history of Roebling (Kinkora), I must briefly allude to some other branches which have been deferred. One of them is the *flat-wire business*. It had a small beginning, after nails were given up, but we kept at it and had much to learn. The manufacture of the hardened and tempered flattening rolls was a hard nut to crack, but was finally mastered to perfection. The machines were all built in our own shop, comprising many styles and sizes, ranging from the tiny bookbinding wire up to the heavy 5- and 6-inch wide flats, for which we bought the raw material outside. It takes some years to find out what does not pay (box strap, for example). The chief specialty is highly-tempered corset wire. It took years of experimenting before perfection in this was reached. Now we have it and propose to retain it. Making these flats gives work to the rolling mills.

The first shop, which of course burnt down, corner of Mott and Clinton Streets, was gradually rebuilt with two stories and lengthened (supposedly fireproof). Here the heavy work is done. At one end the polishing and grinding of rolls is performed. Another building was soon erected alongside, three stories high, the two upper stories devoted to fine flats and corset wire; below are long tempering furnaces, a shipping room, cleaning house, bakers and driers. Recently a long building was erected along Hudson Street for annealing in scale,

AN INSIDE VIEW OF A GREAT INDUSTRY

also for muffling in cast-iron coffins. These extensions are demanded to give work for the rolling mills. On Swan Street is a shop for very fine wire, No. 40 guage, to wind around telephone wires—\$1.00 per pound. Charles put up a remarkable structure for the steam boilers and steam turbines to drive the new rope shop on Elmer Street and part of the wire mill. Self-acting conveyors take the crushed coal aloft and shoot it down the automatically stoking boilers; the same conveyors remove ashes; coal is delivered daily, there being no coal yard any more. The steam turbines are wonderful constructions. The huge cooling towers along the canal give a medieval aspect to that front. Sprinkling systems have been installed for the I.W.D. and the new rope shop. It is all work, nothing but work. The novelty shop is a mass of queer contraptions. We even drill our own diamonds!

FOUNDING THE TOWN OF ROEBLING, 1904

For some years it had become apparent more and more that if we did not make our own open-hearth steel we would soon be left behind in the race. Buying rods abroad was unsatisfactory, as it was uncertain. It took too long, delivery was slow and uncertain. The tariff made the price high. Rods could not be bought in the United States. Neither could we buy billets of the proper quality. Even telegraph wire was made now of very low carbon open-hearth steel, all of which we had to buy.

After examinations of the proposition it was found to be of great magnitude and would cost from five to ten millions. (It is more than that today.)

There were many considerations. The proper site should be not too far from Trenton, with proper railroad facilities, supplemented by water transportation. The first effort was made to acquire the Lalor tract just below Trenton, close at

THE ROEBLINGS

hand with good railroad connection. We had bought a part of it years before. This fell through because the old lady refused to sell at any price! She preferred peace and comfort to money and worry.

Charles then made a systematic search between Trenton and Burlington, finally selecting a site one mile south of the little station of Kinkora on the old Camden & Amboy Railroad. Here he bought a farm having a front on the water of over a mile (afterwards increased to two miles), costing \$200 per acre. An extended riparian line promised to give ample room for dumping slag and ashes, a very important consideration. The farm being a little hilly, a vast level plain was created by dredging and filling in. The Pennsylvania Railroad people were delighted with the prospect of a real big business in place of peaches and potatoes. (The old Camden & Amboy had long been cast in the shade by the Pennsylvania main line.)

A number of things had to be planned. A line of open-hearth steel furnaces, making large ingots; a billet mill to roll the ingots into billets; a new huge rod mill to consume the billets; two new wire mills, all on one floor, for heavy and finer wire; later a fine wire mill was added; an annealing house; a large tempering shop; a galvanizing shop; a large pump house with engines; an electric light station; machine shops; cleaning houses; offices; laboratories; store rooms; storage yards for pig iron, scrap, limestone, coal and general supplies, and above all for billets. All those buildings had to be properly located to best advantage and afterwards connected by suitable lines of communicating lines operated by our own locomotives.

One of the defects of the old Trenton works was they had simply grown up without any plan (there was no room to make a plan). The consequence was that transportation of material between the various shops cost two or three times

AN INSIDE VIEW OF A GREAT INDUSTRY

more than it ought to. All this was obviated at Kinkora. Everything proceeded in a quiet, orderly manner.

Perhaps the most troublesome feature of Kinkora (so named at first) was the utter lack of houses where the working men could live. This could only be overcome by building an entire town, a so-called "model town." Once having the town meant that it be taken care of. It required a large general store where everything a man needed could be bought and was sold to him at a moderate price. It meant a bakery, a drug store, a good hotel. It demanded a water system with pure water, gas, electricity, sewers, drainage, a sewage disposal system, good streets, watchmen, policemen and a jail, a doctor. As more houses were built they were made less pretentious, more suitable for the poor man. Then came a public school, of which our share was \$80,000. With it came taxation problems. The man who owns a town often wishes he had never been born.

BUILDING STEEL FURNACES

To build steel furnaces was a somewhat new departure for Charles. He procured the services of a so-called expert from Worcester, a Swede, who brought with him some Swedish workmen. He remained until several furnaces had been built and were running. At the beginning these furnaces were heated by producer gas, all made in a line of producers running parallel with the line of furnaces. Later on when oil became cheaper and could be supplied steadily, it replaced producer gas to great advantage. To make good steel is not easy. You have to learn how to make both acid and basic steel and prepare your bottoms accordingly. The mysteries of Spiegeleisen, ferro-silicon and ferro-manganese all had to be mastered. The pouring of the steel into the ingot mould, and to make it without blow holes or shrinkage, are all problems not perfectly solved

THE ROEBLINGS

to this day. It took months to learn how to make steel of different degrees of hardness. All had to be learned. What kind of pig iron to buy and what quality of scrap. A good testing laboratory was necessary from the beginning. We began with 12-inch-square ingots and are now preparing for 16½-inch squares.

The blooming or billet mill was the first necessary adjunct to the steel furnaces. It did not involve many new problems. Hydraulic elevating platforms for passing blooms to and from were used (patented). The engines and rolls were well designed and placed; so were the furnaces. Cutting off of billets and placing them on cars by means of a mechanical hand were new features and were designed in Charles' office.

The endless tier of great boilers to furnish steam to the many engines is a most imposing sight. All railroad tracks were conveniently arranged for delivery of material where wanted. To get water from the river a subterranean conduit was built in most treacherous ground, on a bed of peat and in quaking clay. It is 1,500 feet long, terminating near the dock, where there is 14 to 16 feet of water for boats. The building of this conduit was a very big job, well considered and successfully carried out, like everything Charles did.

CHARLES ROEBLING'S FINEST ACHIEVEMENT

With the possible exception of the Williamsburg Bridge cables I think the large rod mill at Roebling is the proudest achievement of Charles' career. It has been admired by many mechanical engineers of the country.

The capacity of this mill is at least three times greater than the old mill up in Trenton. The first part of the mill is built on the continuous plan, with a powerful compound engine alongside, driving the heavy rolls by a succession of geared

AN INSIDE VIEW OF A GREAT INDUSTRY

miter wheels. The remainder of the train, consisting of smaller rolls as the rods diminish in size, is driven by a large pair of compound engines, running at very high speed, connected by driving belts to the fast-running roll shafts. An inspection of this pair of engines, especially when standing under the big belts, gives one an overpowering sensation of the tremendous force that is being exerted. The finished rods, when released from the horizontal winding reels, travel along a conveyor, whence they are pushed into cars, whole trainloads of them. Everything works with a minimum amount of hand labor. These car loads are then distributed around the works or sent to Trenton or elsewhere. The capacity of this mill is greater than the demands of the works, but there are always delays, small breakdowns, or holidays, which reduce it. It is a wonderful sight at night or on a dark day to watch the endless procession of hot rods, with their numerous loops, making their rapid way from end to end of train. The work of the attendants is so arduous that they are spelled every half hour.

Neither let the onlooker forget that all he sees had to be designed and thought out in one man's brain.

MANY ADDITIONS TO THE ORIGINAL PLANT

After the rod mill came the great wire mills, differing radically from those in Trenton, by being arranged all on one floor, giving an oversight at once of everything, doing away with elevators and also with the ever present danger of fire. The driving engines of these mills are also a new departure. For the first time Charles used a hemp-rope drive on a large scale, operated by large compound engines, the many wire benches standing at right angles to the drive. On the opposite sides of the mills are arranged the numerous dryers and the cleaning houses as well as annealers. No. 2 wire mill was built on con-

THE ROEBLINGS

crete piles, the ground having been all filled in. Later on a third mill was constructed, mostly for drawing fine wire on continuous wire-drawing machines, electrically driven. It is a grand sight to see them when they are all in operation. A few heavy benches for spoke wire and large copper wire were also put in. There is capacity here for many years to come.

To complete the cycle of operations a new galvanizing shop and tempering shop were built at Roebling. Six trains of the former, running as much as 30 to 40 wires per pan, the wire being mostly used for strand for telephone and telegraph companies and similar purposes, but little for rope. Here the cable wire for the Manhattan Suspension Bridge was galvanized. Such large plants must be run at their full capacity to be profitable. It looks to me as if we have reached the limit. This shop has been a great relief to the overtaxed galvanizing shop in Trenton, which was one of its objects.

The tempering occupies a very large building with twelve tempering trains operating on the air-tempering principle; furnaces stand entirely on made ground which could not be used for heavy buildings or machinery. The handling of the wire, its transportation from place to place, has been so well designed that the cost of it is reduced to a minimum, compared to Trenton, where it costs two or three times as much. All these shops have their definite foremen, who are looking for a head at Roebling. Where he is to come from is a question for the future. The electric light and power station is a wonder for perfection and size of its machinery, which seems to be adequate for future demands.

The water supply and pumping station, including filtering, is a maze of intricate pipes, elbows, T's, and curves, track of which can only be kept by complete drawings kept up to date in the draughting room. Compared to Trenton, the Roebling

AN INSIDE VIEW OF A GREAT INDUSTRY

works seem to be quiet as the grave, yet the efficiency is double. There is an absence of street noise, of teams handling the freight, the railroad trains are farther off, buildings are larger and further apart, there is an absence of the busy crowds surrounding the main office, or of the gangs of yard men seen in Trenton—matters move on a more majestic scale.

Owing to the expansion of the flat-wire trade in Trenton it was found that there was no room unless the wire-cloth business was moved to Roebing. This was accomplished on the usual grand and complete scale. A large loom shop of three stories adjoins the village; next comes a wire lathing room, storerooms, a galvanizing department and more storerooms for chicken netting, an establishment sufficient for years to come. Space which seemed too vast at the beginning is being rapidly taken up now, even including the land gained by filling in with furnace slag and ashes, and which is very considerable.

Shortly before Charles' death he had planned an enlargement of the blooming mill, likewise the addition of two more steel furnaces, all of which is now being carried on by his successor, Karl G. Roebing.

After the war frenzy a few years of quiet, sedate business seem to be coming, even a year or two of hard times, when money-making almost stops, and no one had the heart to advocate new extensions or new enterprises, whereas that is just the time to inaugurate them. That manufacturing giant, the United States Steel Corporation, was founded on the ruins of a dozen smaller steel works who had given up the ghost.

CHARLES ROEBLING, A MAN OF BOUNDLESS ENERGY

After all, *vitality* supported by good judgment is the best asset. Charles did just about so much work in every year, no matter if the times were good or bad, and in most cases it was

THE ROEBLINGS

found that he had not built enough. Whenever common sense dictated that a certain work should be done, he did not dream about it or postpone it but went right ahead, almost before his brothers knew it. Ferdinand always said that Charles had the building fever bad; no one could stop him, always building and building. He had to have an outlet for his boundless energy.

As a general thing he educated his own foremen. Very few men came from outside. By this method we had men attached to the place and faithful to the management. A carpenter soon became a millwright, a plain wiredrawer could become a foreman, office men were often put in charge of stores. After steel making began at Roebling he found it necessary to become an expert metallurgist. He knew all about the physical properties of steel and its chemical constitution; he kept pace with the progress in microscopic examination of steel. He learned how to make iron telegraph wire in a steel furnace, the lowest grade of all, from that up to .80 carbon. The distinction between acid and basic steel was soon mastered by him and applied in the acquisition of the proper material. He made it a point to go down to Roebling two or three times a week. They knew no other master and now they miss him. His principles were those of the open shop. With union management the walking delegate becomes the real master, he dictates the hours of labor, makes the wages, hires and discharges men, stops piecework and reduces everything to the lowest efficiency. The real owner becomes a mere clerk, allowed to look after orders and finances. His reward is a mere pittance compared to the wages of the men; all progress stops. One great strike cost us \$75,000 but we won out. But enough, I must cease singing his praises.



A Superintendent's House at Roebling, New Jersey



A Typical Street in Roebling, New Jersey

CHAPTER XX

THE BUILDING OF AN INDUSTRIAL TOWN

Roebing-on-the-Delaware

SUPPLEMENTING Colonel Roebing's account of the industrial town of Roebing, as given in the last chapter, written now some twelve years ago, a more detailed history of the enterprise, bringing it up to date, may not be regarded as out of place here. The Colonel once remarked ruefully, with memories fresh in his mind of problems and anxieties which harass the proprietor of a town, "the man who owns a town often wishes he had never been born." Certainly the Roebings have had their share of troubles in connection with this huge project, but the undertaking was at the time a vital necessity for their expanding business, else they would have had to contemplate a diminution of production in competition with their rivals in the trade.

There was at the beginning of the present century no more land available in the immediate vicinity of their Trenton plants; all space was already fully occupied. At first it was thought that a large unimproved acreage to the south of Riverview Cemetery and belonging at that time to the Lalor Estate, would be available. When negotiations were first opened, early in 1903, a price of approximately \$100,000 was asked, although the lands in question were assessed at but \$30,000. When it leaked out that the Roebings were desirous of becoming the purchasers the price was boosted to somewhere in the neighborhood of \$300,000. Indignant at this attempt to take a sordid advantage of their needs, and finding no other

THE ROEBLINGS

property suitable in Trenton, a search was instituted for a tract in proximity to the city which would afford good shipping facilities, and above all where a supply of water was attainable in sufficient quantities. Many sites were viewed, but the prices were prohibitive or there were other objections which rendered them undesirable. Finally a spot was found on the Delaware River about ten miles south of Trenton near a railway station called "Kinkora," on the Camden Branch of the Pennsylvania Railroad. The place, for it was hardly a settlement, is about midway between Bordentown and Burlington. The land selected was high above the water; there was plenty of it and the price asked was reasonable. Some 250 acres were purchased. This was in 1904.

THE PROBLEM OF HOUSING THE WORKMEN

At once the question arose, how about the workmen, where are they to come from? Trenton, the only reliable labor market, was ten miles distant and it could not be expected that men would be willing to make that journey twice a day, even if provision was made for paying the commutation expenses. The only thing to do was to provide homes on the land and make the place a self-contained community. Thus it came about that a town was founded, not as in any way the result of a preconceived ideal, but simply as a plain business necessity. No utopian plans were cherished. There was no thought of establishing a model town or making a philanthropic experiment. The project was viewed purely from a commercial standpoint and apart from sentiment. The Roeblings did not want to build a town and make themselves eternally responsible for it. The thing forced itself on them by the exigencies of the case. They had to have a place where they could expand and thus supply the increasing demand for their wares. As one of them said in an interview at the time:

THE BUILDING OF AN INDUSTRIAL TOWN

“Having determined upon Kinkora as the site for the expansion of our mills we were forced to build houses for the men to live in who will be employed there, and insomuch as we had to build houses anyway, we are building as well as we know how and incidentally we are providing some other things for the benefit of our employees. The rentals presumably will pay the interest on the investment. We do not ask or expect any other returns and we certainly are not posing as idealists or reformers.”

Keeping these points in view the plants were erected and a complete town was built after plans made by Charles G. Roebling. The Roeblings owning the riparian rights, some fifty acres have been added to the property by filling in marsh lands along the banks, thus rendering the river frontage one of the most valuable sections of the town. The whole tract, originally little more than an arid waste of sand, has been gradually transformed into a fertile and pleasing prospect. The sand dunes have been levelled, the ground graded, new soil introduced and shade trees planted. The mills were completed first and occupy a space in the eastern section of some hundred acres, about twenty feet above the level of the river, while the city proper is built to the west of the mills upon a hill about twice as high. To the north of the town a park has been laid out which commands a pleasing view of the river in both directions for several miles. Nothing making for health and convenience has been omitted. There is an ample supply of potable water from a deep well, and the water taken from the river is used only for fire protection and industrial purposes. The streets are from 80 to 100 feet in width and the houses are set back from 20 to 30 feet from the curb, with yards in the rear suitable for garden plots. At the back is an alley where all refuse is collected. The company has a modern

THE ROEBLINGS

incinerating plant. Through the middle of the two main streets runs a parkway with a double row of trees. Surface soil has been deposited in the front and back yards, thus transforming an original waste of sand into veritable garden plots. The company cleans and lights the streets, removes the garbage and gives free unlimited use of water. There is a sewage-disposal plant operated by the company.

The houses are built of brick and have the usual conveniences; gas and electricity are supplied at a minimum cost to the tenants.

THE POLICY OF THE ROEBLING COMPANY

Although the company owns and operates a general store with a fine assortment of goods there is no obligation to trade with it. The company pays all wages in cash but allows credit at the store to those who desire it. The store is not conducted primarily for the purpose of profit, though there is no thought of running it at a loss. The company views its ownership of the town in the light of a business proposition and expects it to pay its way as other departments of the industry. The theory is that the workmen do not want to be patronized or coddled but prefer to be free to go their own way, buy where they like, and pay for what they get. The dictum of the company as laid down at the outset has been strictly adhered to. "The only requisite is for a man to do his work well and behave himself as a householder and citizen. Otherwise we wish him to feel as free as if he were living in his own house on his own land. As far as possible we shall not interfere with his absolute freedom and nothing will be more thoroughly impressed upon him than this fact. We are not giving anything away and the men will be getting only what they pay for. They will be under no obligation to us nor we to them as far as life in the city is concerned."

THE BUILDING OF AN INDUSTRIAL TOWN

These principles have prevailed during the twenty-five years of the town's existence and the results appear to have justified the venture.

The houses are not all of the same grade or character, though all are well built and conveniently ordered. There are homes designed for superintendents and heads of departments as well as for laborers and general workmen, and all at rentals considerably below what would be charged for equal accommodations elsewhere in ordinary towns.

There is no attempt to regulate the lives of individuals. In pre-Volstead days the hotel, which now no longer exists, had a bar where a man could get a drink if he wanted it. This was much objected to in some reforming quarters, but Charles Roebling had a ready reply for all cavillers.

"There is no use," he said, "in trying to make a mollycoddle out of a mill man. When he wants a drink he's going to get it, especially the foreign born. We don't propose to pick his drinks for him. If he wants whiskey it's a good sight better for us that he should be able to get it here like a human being than to trail into Trenton and take a chance with the stuff that goes over the bars where a workingman drinks. The whiskey here isn't gilt-edged but it's decent and worth what it costs."

Of course this was not in accordance with the views of "temperance" people, but it would seem to be common sense and in practice at least kept the drinkers safely at home instead of encouraging journeys abroad where "embalming fluid" was sold and the occasion often ended in a prolonged spree to the detriment of health and the loss of earnings. The Eighteenth Amendment solved the drink problem as far, at least, as the Roeblings were concerned, but whether matters are any better under present conditions is another story.

THE ROEBLINGS

A PROGRESSIVE TOWN

Besides the post office and the public school there are a police station, a fire-engine house, a hospital, a bank, a public library, and a sanitary barber-shop. There are no churches within the immediate precincts of the town, but there are several on the outskirts. There is a drug store and a grocery store run by private parties. The bank, known as the First National Bank and Trust Company of Roebbling, is locally organized and managed and most of the stock is locally held. A spacious assembly hall with stage and drop-curtain, showing a representation of the Brooklyn Bridge, and an auditorium in which the seats are removable thus affording a ballroom of impressive dimensions, yields ample opportunity for entertainments and social diversions. For outdoor sports, there is a baseball field and several tennis courts. The company supplies coal, wood, and ice and has a fenced-in parking yard with an up-to-date filling station. Roebbling in short is equipped with all the buildings and accessories that any progressive town could possibly desire, and there are no slums.

If Roebbling does not call itself a "model town," perhaps the title belongs to it just the same. If it was a commercial venture first and foremost, built and organized out of a business necessity which arose, it has succeeded in developing into something greater and finer. It is a community of happy contented people, at least so far as there is such a thing in a world that yet leaves much to be desired for the satisfaction of human ambitions and hopes. Not designed in any sense as a Utopia, or built as the result of philanthropic ideals, but rather frankly contemplated as an industrial town which was designed to pay its own way, Roebbling seems to have justified its existence, and the hopes of its proprietors.

The place originally going under the name of Kinkora, by

THE BUILDING OF AN INDUSTRIAL TOWN

a natural process has come to be known as Roebing after its founders, and is now so registered by the Post Office authorities. Kinkora as a railroad station still survives but whatever glory it once may have had is now in eclipse, for Roebing is only a mile away and it is a real town with real inhabitants.

There are some 750 dwelling houses, all of which are occupied by the Roebing workmen and their families, and the total population at present numbers about 3,600 souls. Other workmen live on the outskirts of the town and some 200 more make the ten-mile journey to and from Trenton twice a day. The company pays all the taxes and other assessments, including the salaries of the police and firemen. Besides the mills originally established, large additions have been made to the plant from time to time. There are now an open-hearth steel mill, a blooming mill, two rod mills, four steel-wire drawing mills, one copper drawing mill, galvanizing, tinning, and heat-treating shops and a wire-cloth factory.

CHAPTER XXI

IMPROVED METHODS OF CABLE MAKING AND MAJOR BRIDGES OF RECENT CONSTRUCTION, 1903-1924

IN THE early period John A. Roebling himself acted as designer, engineer, superintendent and also usually as contractor for the works which he constructed. He always declined to furnish plans for an important structure that could not be erected under his personal supervision, neither would he undertake work upon plans made by others. He was not an imitator; all his great constructions were essentially different, and planned to meet the special features of the location, and when he had once decided upon his plan, he was sanguine of its success, and his whole energies were directed to its accomplishment.

His own eye must examine every portion of the structure as it was put together, and nothing beyond the manual labor was intrusted to others.

It was not unusual for him to take part of his pay in stock of the company for whose account he erected the aqueducts and bridges. Later on, in the case of the larger projects, he only acted as the designer and engineer, and the materials, which, however, he always carefully tested, were purchased in the open market. This was the case with the Niagara Falls Suspension Bridge and later with the Brooklyn Bridge which was, however, completed by his son in 1883.

Since the time of the Brooklyn Bridge the Roebling Company have seldom acted as the official engineers for the larger public structures with which their name is associated. In the case of smaller private works when it was desired they have

IMPROVED METHODS OF CABLE MAKING

acted not only as the engineers but also as the contractors as well, and they still do this today.

In connection with the greater structures, the Roeblings merely provide the wire cables and are responsible for placing them in position under contract. At the present time corporations and municipalities, undertaking great public works, prefer to employ their own engineers directly responsible to themselves.

Of course the engineering fees constitute relatively a small item in the general cost of big undertakings and it is much more profitable to supply the wire cables required and erect them under contract than to act as general engineers for corporations concerned. As Colonel Roebling once observed, "our engineering projects have brought us reputation but little money." In other words, the Roeblings today are primarily manufacturers of wire and wire rope for sale to the trade or for use in the bridges which they may be called upon to build; and only secondarily engineers, except in so far as their own mechanical problems are concerned.

The Roeblings have, however, an efficient corps of engineers in their employ whose services are available for operations in which they may be engaged, though they are also prepared to undertake contracts for the entire work, whatever its magnitude.

While the general design of bridges today follows the lines so successfully initiated by John A. Roebling, since his time there have been many improvements effected in materials, the fabrication of cables and methods of construction.

The Brooklyn Bridge marked the first use of steel as a material for bridge wire. All previous suspension bridge cables were fabricated from wire drawn from charcoal iron.

Prior to this time, cables were fabricated from bright wire

THE ROEBLINGS

and depended upon oil, grease, and paint for protection against the elements. In the Brooklyn Bridge, however, the cables were fabricated from galvanized wire, thus bringing into use, for the first time, zinc as a protective coating for suspension bridge cable wire.

AN ACCOUNT OF THE PROCESS OF WIRE-CABLE SPINNING

It is interesting to note that the fundamental principle of parallel wire-cable spinning, that is, the aerial spinning process which was invented by John A. Roebling in 1854, during the construction of the Niagara Falls Bridge, is still accepted today as the most practical and economical means of fabricating these huge cables, each containing many thousands of individual wires.

In order to fabricate parallel wire bridge cables by the aerial spinning process, it is first necessary to make the bridge cables, while under construction, accessible throughout their entire length from anchorage to anchorage. It is also necessary to support the aerial rope tramway, used in the spinning of the strands, at various points on each span.

To attain these objectives separate footbridges are erected directly below and about three feet from the final contour of each of the proposed cables. The width of these footbridges varies between six and fourteen feet, depending largely on the size of the main cables, since the bridges must be wide enough to permit the spinning of two strands on each side of the line of the proposed cable, as well as to allow the workmen freedom of movement and easy access to the cable during all stages of its fabrication. Connections are established between the footbridges at various intervals, usually at the mid and quarter points of the spans, by means of trussed cross-bridges so that easy communication is afforded from all parts of the structure. These cross-bridges also serve to stiffen the footbridges later-

IMPROVED METHODS OF CABLE MAKING

ally in conjunction with a system of storm cables suspended below the footbridges in the form of an inverted parabola, the storm cables being anchored to the tower bases, and the connection to the footbridges being made at various intervals by vertical guys. The aerial rope tramway is supported by towers which are erected on the footbridges and spaced to provide efficient tramway operation.

The whole structure is supported by lengths of galvanized wire ropes stretched from anchorage to anchorage, and passed over the tops of the towers in saddles especially provided for them. It is standard practice to make these footbridge ropes to meet the specifications of the suspender ropes in the finished bridge, so that upon the completion of the work of spinning and compacting the cable, the footbridge may be suspended from the cable itself by means of wire rope lashings at proper intervals, and the footbridge ropes removed and cut into the proper lengths to be used as suspender ropes. The footbridges are thus left in place to be used in the final wrapping of the cables.

The maximum stresses in the footbridges being determined, enough lengths of footbridge rope are used to maintain the proper factor of safety. It is customary to use two groups of two, three, or five lengths each, for each footbridge, and when the lengths required per group are in excess of two, they are placed in two layers, each group being clamped together at the floor beam points, to maintain a uniform cable throughout its entire length. It is necessary to adjust these ropes with considerable accuracy so that the footbridges will hang in the proper relation to the proposed cables.

The frame work of the footbridges, which is of timber construction, consists of a system of floor beams, stringers, and braces covered by floor boards with cleats placed upon them to

THE ROEBLINGS

provide sure footing on the steep grades. The timber is framed on the ground, hoisted to the tops of the towers, carried out on both sides of each tower at the same time, and attached to the ropes in sections, the floor beams resting upon the ropes. It is essential that the work of erection be carried out on each span at the same time, thereby maintaining balanced stresses at the towers.

THE LATEST METHOD OF CABLE CONSTRUCTION

The construction of the cables for the Bear Mountain Bridge, completed in 1924, may be said to have been the turning-point in the history of parallel wire-cable fabrication, as several new theories, put to a rigid test during the construction of these cables, proved very successful and opened the field to cables of practically any diameter and number of wires.

Under the old method of construction the strands when finished were bound together at intervals throughout the entire length of strand by bands of round serving wires. When a sufficient number of strands were completed, seven of the strands in the middle of the cable were bound together to form a central core, and all of the above-mentioned round wire servings were removed from the individual strands. After the central core was completed the next outer layer of twelve strands was formed around this core in a similar manner, and each successive layer was formed around these as a core until the cable was completed. The squeezing jacks were then applied and the cable was compacted to its finished diameter. This, it will be observed, was a slow and tedious procedure.

To eliminate this practice, flat wire bands for serving the individual strands were introduced for the first time in the Bear Mountain cables with the idea of leaving them in the finished cable, thus doing away with the necessity of forming

MAJOR BRIDGES OF RECENT CONSTRUCTION

the seven-strand core and successive outer layers and permitting the cables to be compacted from their true hexagonal formation, as spun, to their finished circular cross-section of pre-calculated diameter, in one operation. The flat wire bands were removed from the outer layer of strands only, leaving an appearance of a closely compacted mass of parallel wires around the entire circumference of the cable.

A brief description of some of the more notable structures built by the Roeblings during the present century may be welcomed in interested quarters.

WILLIAMSBURG BRIDGE, 1903

This bridge, completed in 1903, has a main span of 1,600 feet between towers, and is supported from four cables, $18\frac{3}{4}$ inches in diameter, each consisting of 37 strands, and each strand composed of 208 wires 0.192 inches in diameter, totaling 7,696 wires in each cable. The suspended length of each cable is 2,985 feet between center lines of anchorage pins, and the four cables contain a total wire length of 17,432 miles. The ultimate strength of each of these cables is approximately 22,300 tons.

MANHATTAN BRIDGE, 1909

The Manhattan Bridge, the latest of the New York City suspension bridges, was opened to traffic in 1909 and has a main span of 1,470 feet, supported from four cables $20\frac{3}{4}$ inches in diameter, and consists of 37 strands. Each strand is composed of 256 galvanized wires 0.195 inches in diameter, making a total of 9,472 wires in each cable. The total length of each of the cables is 3,224 feet between center lines of anchorage pins. The continuous wire length of the four cables totals 23,170 miles, and the ultimate strength of each of these cables is approximately 28,300 tons.

THE ROEBLINGS

PARKERSBURG BRIDGE, 1916

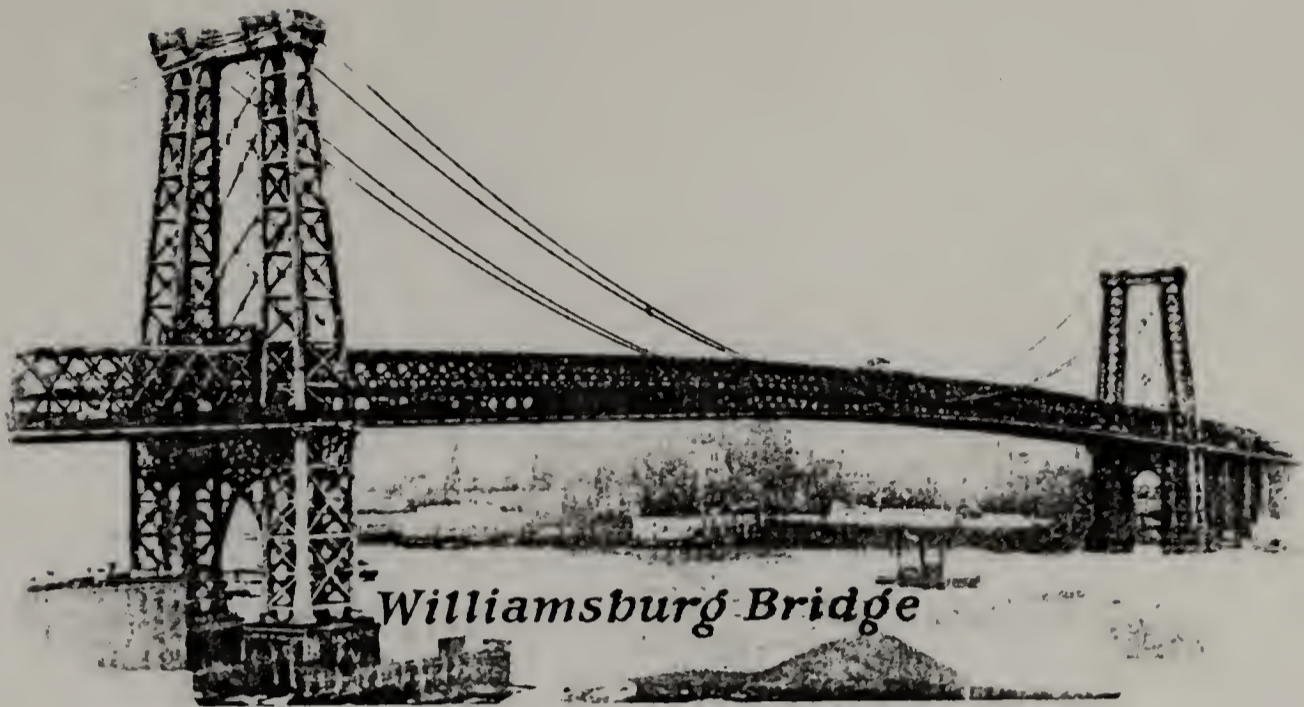
This bridge was built in 1916 across the Ohio River at Parkersburg, West Virginia, and consists of three spans of 275 feet, 775 feet, and 375 feet respectively. The bridge is supported by two cables each $8\frac{1}{4}$ inches in diameter, composed of seven strands each having 280 galvanized wires 0.165 inches in diameter, totalling 1,960 wires in each cable.

RONDOUT CREEK BRIDGE, 1922

This bridge, spanning the Rondout Creek at Kingston, New York, was opened to traffic in 1922, and is one of the more recent bridges supported by cables of Roebling wire. It has a main span of 705 feet and is supported by two cables 9 inches in diameter, consisting of seven strands, each composed of 282 galvanized wires 0.195 inches in diameter, totalling 1,974 wires in each cable. Due to the steepness of the backstays, it was necessary to add two extra strands from each tower to the anchorages, these strands consisting of 76 wires, so that each of the backstay cables contained a total of 2,126 wires. The total length of wire in both of these cables equals 936 miles, and the strength of each cable approximates 6,320 tons for the main span, and 6,803 tons for the side spans.

BEAR MOUNTAIN BRIDGE, 1924

The Bear Mountain-Hudson River Bridge, the latest of the greater bridges except the colossal Hudson River Bridge now approaching completion, was dedicated and opened to the public on November 26, 1924, thus completing, after record progress for this type of construction, one of the longest span bridges in the world devoted entirely to highway traffic. The opening of this bridge provides a greatly needed short route for east-and west-bound traffic between New Jersey, Pennsylvania, and New York, on the western side of the river, and the New Eng-



Completed in 1933



Completed in 1909



The Bear Mountain Bridge across the Hudson River, Completed in 1924

MAJOR BRIDGES OF RECENT CONSTRUCTION

land States on the eastern side, as well as the Empire State itself.

Crossing the Hudson River from Anthony's Nose, on the east bank, to the site of historic Fort Clinton, at Bear Mountain, on the west bank, about 42 miles above New York City, this bridge provides the first highway crossing the Hudson River below Albany.

It was at the exact site of this bridge in 1779, while George Washington was concentrating his forces at West Point, and "Mad Anthony" Wayne was storming Stony Point, that the Continental Army stretched huge chains across the river to prevent the British fleet from passing up the river to attack West Point.

The first charter for a bridge at this site was obtained in 1868, and many attempts to undertake construction have been made since. The present charter, however, was obtained during 1921. The contract for construction was signed on March 24, 1923, and work was commenced at once.

This bridge is of the parallel wire cable suspension type with straight "unload" backstays. The main span provides a clear unobstructed distance of 1,632 feet between the towers, which are situated near the water's edge on each shore. Passing ships have a clearance of 155 feet at the center of span at high tide, which will not endanger the tallest masts or towers. Suspended from cables is a reinforced concrete highway 38 feet wide with a 5-foot sidewalk on each side. The west approach consists of two 50-foot spans, one 100-foot span, and one 200-foot span, while the east approach consists of a single 210-foot span.

The bridge was designed to provide a floor system capable of carrying 15-ton and 20-ton trucks, so as to fully meet the requirements of modern highway traffic. The specified load of 70 pounds per square foot for the general live load on the main

THE ROEBLINGS

span roadway is equivalent to a total of 216 10-ton trucks, or four lines of 54 trucks each.

The two towers are 350 feet high and rest upon concrete piers, carried on solid rock foundations. They have a base width of 89 feet 10 inches and a width of 61 feet 4 inches at the saddle.

The completed main cable is made up of 37 strands of 7,252 wires, which have a finished diameter after compacting and wrapping of 18 inches and a strength of approximately 23,600 tons. The wire used in these cables is 0.192 inches in diameter before galvanizing and has an ultimate strength of 215,000 pounds per square inch after galvanizing. The cables are supported on cast steel saddles at the tower tops and are rigidly fixed to the tower saddles by means of steel casting clamps. The towers being of the flexible column type, are designed so that their flexure will compensate for any longitudinal movement of the cables, due to variation in temperature or live load stresses. The total cost of the bridge was \$6,189,000.

For the technical details in this Chapter I am indebted to Mr. C. C. Sunderland, Chief Bridge Engineer of John A. Roebling's Sons Company.

H. S.

CHAPTER XXII

THE THIRD GENERATION AND AFTER

OF THE four grandsons of John A. Roebling who reached adult years, only two, Karl G. Roebling and Ferdinand W. Roebling, Jr., sons of Ferdinand W. Roebling, have been actively associated with the company in an official capacity; however, John A. Roebling, 2nd, served as a director for a brief period.

JOHN AUGUSTUS ROEBLING, 2ND, 1867

The eldest grandson, John Augustus Roebling, 2nd, the son and only child of Washington A. Roebling, after graduating with the degree of C.E. from the Rensselaer Polytechnic Institute in 1888 remained in the industry only for a brief period, being engaged at the mill in making independent experiments and researches. Severing his connection he thenceforth devoted his leisure to scientific investigations mainly in the realm of chemistry conducted in his private laboratory. He was born in Muhlhausen November 21, 1867, while his parents were on a visit to Europe in connection with Colonel Roebling's study of caisson construction preparatory to his work on the Brooklyn Bridge. On June 12, 1889, John married Margaret Shippen McIlvaine, daughter of Edward S. McIlvaine of Trenton, and a granddaughter on the mother's side of Commander William Edgar Hunt of the U.S. Navy, who, as related in a previous chapter, sold to John A. Roebling in 1848 the property in Hamilton Township where the original Roebling works were located. The couple had three sons: Siegfried, born December

THE ROEBLINGS

29, 1890; Paul, born May 1, 1893; and Donald, born November 15, 1908. Paul died December 16, 1918. The family lived for a number of years in Asheville, North Carolina, subsequently removing to Bernardsville, New Jersey, the present home, where Mrs. Roebeling died in 1930.

KARL GUSTAVUS ROEBLING, 1873-1921

Karl Gustavus Roebeling, the eldest son of Ferdinand W. Roebeling, and at the time of his death in 1921 president of the John A. Roebeling's Sons Company, was born in Trenton, July 7, 1873. He received his preliminary education in the State Model School in Trenton, subsequently preparing for his collegiate career at the Lawrenceville School. He matriculated at Princeton University in the Class of 1894. He then entered the employ of the company beginning at the bottom of the ladder as an ordinary millhand from which he worked his way up through the various departments of the industry, thus making himself familiar with the practical workings of the business in its many phases. Later he became associated with the sales department, working directly under the eye of his father, until he himself became chief of that important division. In connection with his office as general manager of the sales department he travelled extensively, visiting repeatedly the company's branch stores in the various cities of the United States and going as far afield in the interest of his department as Mexico and South America. He thus became thoroughly conversant with the wide-flung activities of the industry and with the financial operations involved in the maintenance and promotion of its vast interests. Upon the death of his father in 1917, Karl became second vice-president while also remaining general sales manager. Upon the death of his uncle, Charles G. Roebeling, in 1918, he was chosen president of the company and so remained until his death in 1921.



Karl Gustavus Roebling, President, John A. Roebling's Sons Company, 1918-1921



*Robert Clowry Roebing, Son of Karl G. and Blanche Estabrook
Roebing*

THE THIRD GENERATION AND AFTER

During the World War and the tremendous demand for the Roebling wares which that exigency created, an excessive burden of administration was laid upon his shoulders which he met with unflagging courage and the natural energy wherewith he was endowed. Besides the normal calls upon him in connection with the general business of the company and his directorship in many corporations, there was the settlement of his father's estate and the onerous responsibilities thrust upon him due to his appointment in 1917 as chairman of the committee of the Iron and Steel Institute, which at the request of the United States government took over the production and distribution of wire rope to supply the needs of the war. Of all that this involved no one at the time had any clear idea, but the task proved a herculean one. He fulfilled all these obligations conscientiously and with conspicuous ability, but the strain ultimately proved too much for him and he broke under it. Though naturally robust and gifted with a tremendous capacity for work, his excessive labors and the additional anxieties which the war brought sapped his strength and wore him out long before his time. He was averse to taking any vacations or to any cessation of his numerous activities. At the earnest solicitation of his family and friends he consented to take a short holiday with a trip to South American waters, but returned little benefited by the sojourn and proceeded with his usual energy to plunge again into his duties. The only recreation he allowed himself was an occasional hour on the golf links. He had a summer home at Spring Lake, New Jersey, where he spent all the time he could snatch from his business. It was while playing golf on the links of the Spring Lake Country Club May 29, 1921, that he was stricken down by an attack of apoplexy. While making a stroke he fell to the ground unconscious and died almost instantly. He was in the

THE ROEBLINGS

forty-eighth year of his age. The funeral was held from his Spring Lake home on May 31. The body was interred in the family plot in the old Ewing Church Cemetery near Trenton. As a mark of respect to his memory and as a token of his fine citizenship the mayor of Trenton, Frederick W. Donnelly, issued a proclamation requesting that the factories and business houses should close their doors during the time of the funeral services. This recommendation was largely complied with.

The death of Mr. Roebling was keenly felt in Trenton, not merely because he was the head of its largest industry but because he was greatly admired in the community as a private citizen for his personal qualities and the intelligent interest he had always shown in its affairs, civic and charitable. The death of Karl G. Roebling was widely noted in the chief newspapers of the country and many tributes were paid to his memory by his business associates in the various corporations and societies with which he was connected. At a special meeting of the board of directors of the John A. Roebling's Sons Company the following resolution prepared by Colonel Washington A. Roebling was adopted, duly setting forth the loss to the company occasioned by Karl Roebling's death and paying a fitting tribute to his memory:

COLONEL ROEBLING'S TRIBUTE TO KARL G. ROEBLING

"With the deepest sorrow and regret, I announce to this board the sudden death of our beloved president, Karl G. Roebling, on May 29, 1921. At the moment, it seems to be impossible to replace him. His knowledge of our whole business: his grasp of our troublesome affairs: his genial relations and affable intercourse with all our staff, as well as workmen, cannot be reproduced in any one person. That the great responsibility must have been beyond his powers is evidenced by his untimely demise. Although always cheerful, hopeful, and

THE THIRD GENERATION AND AFTER

filled with an inexhaustible desire for work, this sense of human limitation must have been ever present.

“In his qualifications as an organizer; as a manager of every department, down to the smallest detail, I maintain that he has excelled all of his predecessors in his office. In addition, he managed his own personal affairs, which were extensive; he attended to his father’s estate; found time to keep watch on political matters that might be of advantage or disadvantage to our business. He had a vision for the future. His heart and purse were ever open to the appeal of the needy. In the mill, he made many improvements for the comfort of the men. He enjoyed the respect, and affections, of every one he came in contact with, and had achieved a reputation which extended far beyond the limits of his home town.”

Mr. Roebling married, November 20, 1902, Blanche Estabrook, daughter of Henry D. Estabrook, general counsel of the Western Union Telegraph Company and a brother-in-law of Robert Clowry, president of the company. There were three children, a son and two daughters. The son, Robert Clowry, was born September 22, 1904, married Dorothy Ripley of Newark, New Jersey, June 20, 1925. The couple have two children. Of the two daughters of Mr. and Mrs. Karl G. Roebling, Allison, born December 1, 1907, married Baron Joseph Van der Elst, an attaché of the Belgian legation, and Caroline, born December 2, 1911, married June 7, 1930, Alexander B. Hagner of Washington. The former Mrs. Karl G. Roebling has remarried and is now Mrs. Arthur O’Brien of Washington.

Karl Gustavus Roebling was originally named Charles Gustavus, after his distinguished uncle. Subsequently he had his name legally changed to Karl Gustavus, doubtless to prevent his being confused with his uncle, a matter which was of some importance when he became an official of the company.

THE ROEBLINGS

KARL ROEBLING'S DEATH A GREAT LOSS TO ROEBLING INDUSTRY

It is not too much to say that the unlooked-for death of Karl in the flood tide of his career and coming so soon after that of his father and uncle, was a great calamity to the Roebbling Company. In his subordinate position he had done much for the systematization of the sales department, increasing its efficiency by the introduction of new methods and winning the goodwill and even affection of his helpers by his courtesy and considerateness. In the three short years during which he held the presidency, a period representing the aftermath of the World War, there were grave problems to solve connected with a necessary readjustment and reorganization of the industry. He had formulated important plans of a far-reaching nature which his death, to say the least, interrupted if it did not permanently postpone. Intimately conversant with all the details of the business from his early manhood, Karl brought to it all the family energy and ability and it was his worthy ambition to accomplish even greater things in the future. His whole heart was given to the business for he had no serious outside interests. There was no employee of the company who worked harder or put in more hours. He was often at his office by 8 o'clock in the morning and frequently remained there until 6 o'clock at night, besides sometimes returning again for an evening session. In his manner he was very reserved, even shy, and cultivated few intimates, always preserving an aloofness from ordinary forms of social life. He was gracious to all, but kept his own counsels. In his home life he was always affable and could converse with fluency on most topics. He was a constant reader of good books, particularly along historical lines, and he remembered what he read.

Few men had a higher sense of personal honor and he carried this sentiment sometimes to an almost quixotic extent. This

THE THIRD GENERATION AND AFTER

quality may be illustrated by an incident known only to a few.

It seems that in the hearing of one or two friends, who had great confidence in his financial judgment, he happened to mention a certain stock of which he thought well and of which he, himself, was a substantial owner. These friends straightway invested in the stock which later declined considerably in value. They did not and could not justly complain that they had been misled by any representation, on his part, but nevertheless the matter preyed upon his mind and he determined that they should not be the losers on account of any favorable opinion he might have expressed as to the stock in question. Accordingly Mr. Roebling entered into a confidential arrangement with a broker to make an offer to his friends to purchase their stock at a figure which would cover its depreciation. This the broker did and the friends, though greatly surprised at the offer but suspecting nothing, naturally took advantage of the opportunity to regain what they had lost. The story is here told for the first time and if the parties concerned ever read this narrative they will have an explanation of a matter which must at the time have occasioned them some astonishment.

FERDINAND WILLIAM ROEBLING, JR., 1878

After the death of Karl G. Roebling, Colonel Washington A. Roebling, as heretofore related, became president of the company and at the same time his nephew, Ferdinand W. Roebling, Jr., was chosen vice-president.

Ferdinand W. Roebling, Jr., the second son of Ferdinand, Sr., was born in Trenton, September 29, 1878. He was educated in the State Model School and the Adirondack-Florida School, where he prepared himself to enter Lehigh University. In accordance with the family tradition he elected to take the engineering course and was graduated in the Class of 1901, receiving the degree of Mechanical Engineer. He at once en-

THE ROEBLINGS

tered the employ of the company and was placed in the engineering department under his uncle Charles. Charles was an impatient and rigorous taskmaster and was far from showing any favors to his young nephew, who, however, by his assiduous application to his duties and his conspicuous abilities, finally won his full confidence and even his ungrudging approbation.

The Roebling mill is a great school for testing the mettle of young engineers. There is always plenty of hard work to be done and many difficult problems to solve. With the usual pertinacity of the Roebling stock, Ferdinand plodded his way through his long apprenticeship and in due time won his spurs as a fully qualified engineer. In referring to this portion of his career Colonel Roebling once said to James Kerney, publisher of the Trenton Times Newspapers, that he regarded his nephew Ferdinand as one of the best engineers the Roebblings ever had, and the Colonel was not wont to indulge in flattery, especially in the case of his own relatives. "Praise from Sir Hubert is praise indeed."

While in the engineering department Ferdinand designed patterns for new machinery for wire-drawing which are still in use, and also worked on the plans for the Williamsburg Bridge and other structures built by the Roebblings. Subsequently he was transferred to his father's department and in 1914 was made assistant treasurer. In 1917, following his father's death, he succeeded him in the office of secretary and treasurer of the company. Ferdinand is regarded as an expert authority on matters of finance, his judgment of values in the security market being relied upon by his associates in the company and in the various banking institutions with which he is connected.

Following the death of his brother Karl in 1921 he became vice-president of the company while also remaining treasurer.



*Ferdinand William Roebling, Jr., President, John A. Roebling's Sons Company,
1926—*

THE THIRD GENERATION AND AFTER

Upon the death of his uncle, Washington A. Roebling, in 1926, he succeeded him in the presidency of the company, a position he still holds.

Like his father, Ferdinand has always been disinclined to accept public office, though he did serve for some years as a member of the Trenton Water Board, an honorary position. He was also a presidential elector in 1928. He is one of the directors of the First-Mechanics National Bank, Trenton, and of the Chase National Bank of New York, and is also associated with other corporations at home and elsewhere.

In 1925 Mr. Roebling was awarded the Trenton Times Civic Cup, a trophy until recently given annually to a citizen of Trenton, adjudged by a selected board of representative men and women of the city to be worthy of the honor by reason of his devotion to the cause of good citizenship, "as revealed by personal character, excellent example and continuous services to the community, whether manifested in public or private life." This award is locally regarded as a great distinction and as conferring upon the person chosen the deliberate approval of his fellow-citizens.

Ferdinand married, October 4, 1905, Ruth Metcalf, daughter of Joseph P. and Celia Fletcher Metcalf, of Erie, Pennsylvania. A house adjoining his own on West State Street was provided for the young couple by Ferdinand, Sr., and there they lived until the father's death in 1917, when they occupied the paternal mansion where they have since resided. Several years ago a summer home with extensive grounds was purchased at Spring Lake, New Jersey. The place is directly on the sea-front with beautiful lawns and elaborate sunken gardens. It is regarded as one of the show places of the resort.

Socially prominent alike in Trenton and Spring Lake, the Roeblings are hospitably inclined and delight in entertaining

THE ROEBLINGS

their many friends. Mrs. Roebling is actively connected with many charitable associations, being deeply interested in the hospitals, at Spring Lake and Trenton, and particularly in the work for the crippled children in the Trenton Orthopedic Hospital, for the building, extension, and support of which both she and her husband have been largely responsible.

During the past decade, a period when many "drives" in aid of hospitals and other community interests were held, whereby a total of over six million dollars was locally subscribed, Mr. Roebling has played a prominent part. Besides making liberal contributions he also acted as manager of the campaign for the raising of six hundred thousand dollars for St. Francis Hospital, in which the Roeblings have always felt a special interest. There is no individual in the city who has more consistently demonstrated his willingness to do his full share in all worthwhile movements for Trenton's civic and philanthropic betterment.

Thoroughly identified with local interests, and as the chief representatives of the Roebling name now living in Trenton, the Ferdinand Roeblings sustain a unique place in the inherited regard of the community for a distinguished family to whom Trenton owes so much for its industrial and civic development during the past eighty years.

The Roeblings have two sons, Joseph Metcalf, born April 13, 1907, and Ferdinand W., 3rd, born November 1, 1911. Of these, Joseph, educated at Princeton University, is now undergoing his training in the industry, and Ferdinand, 3rd, is at present a student in the same institution, and expects to enter the business after his graduation.

OTHER DESCENDANTS OF FERDINAND W. ROEBLING, SR.

Descendants of Ferdinand W. Roebling, Sr., on the female side are his two daughters and their children; the eldest, Mar-



Mrs. Ferdinand W. Roebling, Jr., née Ruth Metcalf. From a Painting by Arthur Halmi



"Lowlands," the Summer Home of Mr. and Mrs. Ferdinand W. Roebling, Jr., at Spring Lake, New Jersey



*Joseph Metcalf Roebling, Eldest Son of Ferdinand W. and Ruth
Metcalf Roebling*



*Ferdinand William Roebling, 3rd, Second Son of Ferdinand
W. and Ruth Metcalf Roebling*

THE THIRD GENERATION AND AFTER

garet Johanna Roebing, born July 22, 1869, was married to Frederick A. C. Perrine, D.Sc., June 28, 1893. They had three children, Margaret, born April 16, 1894, married to Kenneth W. Moore, November 3, 1915, died October 22, 1929; Anne Allison, born December 10, 1896, married to Robert T. Bowman, June 11, 1921. The Bowmans have a daughter, Margaret Roebing, born March 2, 1930. Besides the two Perrine daughters there was a son, John Augustus Roebing, born March 13, 1903, died August 1918.

The second daughter of Ferdinand W. Roebing, Sr., Augusta Henrietta, born September 19, 1875, was married to William Townsend White, February 4, 1903. There are two children, of whom Margaret Roebing, born November 20, 1904, was married to George Rea Cook, 3rd, June 23, 1926. The Cooks have one daughter, Margaret Allison, born April 18, 1930. The only son of Mr. and Mrs. White, Ferdinand Roebing, was born November 14, 1907. He matriculated at Princeton University in the Class of 1931 and is now vice-president of the Union Mills Paper Manufacturing Company and the Universal Paper Bag Company, both at New Hope, Pennsylvania.

TWENTY-THREE DESCENDANTS OF JOHN AUGUST ROEBLING NOW LIVING

Of the descendants of John A. Roebing and his wife Johanna, reckoning through their sons only, there were thirty-two in all, of whom twenty-three, including male and female, are now living. Of those bearing the Roebing surname there are only seven living, but the stock is a sturdy one and not likely to be extinguished. From present indications it would seem probable that there will not be lacking in the future representatives of the Roebing name to carry on the great industry originally founded by their progenitor, now some ninety years ago.

CHAPTER XXIII

THE ROEBLINGS IN THE WORLD WAR

THE CRUCIAL period of the World War naturally imposed an excessive strain upon the Roebling industry and speeded up the production of wire to almost incredible limits. Colonel Roebling in a previous chapter has dealt discursively with certain phases of this subject, but some further details would seem to be called for to complete his brief summary.

Owing to the scarcity of skilled labor and the tremendous demands upon general industry for supplies of all kinds, the wire manufacturers were at their wit's end to produce the vast quantities required of them. After Uncle Sam entered the war the capacity of the Roebling Company for wire rope was quickly increased until at the peak of the demand it rose to figures 75 per cent above the normal, while the number of workers employed ran close to ten thousand men. Perhaps no one knows exactly how much wire and wire rope were produced during these feverish two years, but the quantity estimated runs into unthinkable millions of feet.

WAR CAUSES ENORMOUS DEMANDS FOR WIRE

The cry for wire and ever more wire for hundreds of diverse purposes, both for the needs of the Allies and for our own forces, was urgent and incessant. So essential to the purposes of the war were the various products of the wire industry that it soon became evident that the demands could not be met without a complete coordination of all the mills engaged in the manufacture. The wire plants of the country, those equipped

THE ROEBLINGS IN THE WORLD WAR

for mass production, are not numerous and some of them are far removed from the seaboard and thus lack transportation facilities—a distinct handicap when it is a question of haste in delivery. To meet the emergency, the Iron and Steel Institute at the request of the government formed a committee to manage the production and distribution of wire rope and Karl G. Roebling, as related in the preceding chapter, was appointed chairman, and the Roebling works in Trenton were designated as the official headquarters. Here the committee held its constant meetings and determined ways and means of increasing production and the apportionments to be assigned to the various wire manufacturing plants of the country. There was no possible question of rivalry as to the amount to be allocated to each. It was rather a question as to how much each plant could produce under the pressure of a great necessity.

What increased the difficulty was that the extra-normal commercial demand for wire and wire rope had also to be met, for many other war-time industries were dependent for their efficiency upon the products of the wire mills. It would not do to deprive equally essential industries of a commodity requisite to their proper function; thus wire rope for the transportation of coal and ores, the running of elevators and a hundred other forms of activity had to be supplied. Unity of effort along all essential lines had to be maintained, for a breakdown in any affected all the others. Moreover, it was not merely wire in its ordinary staple forms which was required for war purposes, but rather a specialized product to meet certain specific needs. Special machinery had in many cases to be installed, new problems to be solved and even a new organization to be created. That all these things were accomplished in a few brief months constitutes a remarkable tribute to American ingenuity and adaptiveness.

THE ROEBLINGS

All the orders for wire rope emanating from the several government departments, Army and Navy, with their various bureaus, were centered at the Roebling's offices in Trenton. A host of government inspectors and experts were drawn thither, with a corresponding number of military and naval officers, all pressing the respective needs and the urgent necessities of their respective requirements.

WIRE COMMISSION FILLS ALL ORDERS PROMPTLY

Had it not been for the valuable experience obtained in working for the Allies previous to our own entry into the war, it is probable that the complete success of the wire committee in meeting the additional huge and multifarious demands of our own government could not have been attained. As it was when hostilities ceased the Wire Commission was able to boast that all the orders of the government had been promptly met and to the entire satisfaction of all concerned. This is a record of efficiency which it is safe to say no other branch of industry engaged in war production has surpassed, if indeed equalled.

The part taken by the Roeblings in the manufacture and supply was a predominating one among the several concerns furnishing wire and wire rope for war purposes. The long and varied experience of this company in manufacturing a high grade of wire specialties stood it in good stead when the call came. Especially in the production of aircraft wire and strand and cord for all the parts involved was their efficiency to be noted. Having from the very inception of aviation paid particular attention to the requirements of this service the Roeblings were spared the necessity of hurried experimenting in this difficult field, for they had learned it all before.

Among other emergency orders there came from the Quartermaster's Department a call for nearly seven million feet of wire rope in the manufacture of three hundred thousand pairs

THE ROEBLINGS IN THE WORLD WAR

of traces, requiring three million splices. Ordinarily in the making and fitting of these splices a half hour's work is required, but though most of the workmen in the Roebling plants at that time were unskilled, the work was speeded up so that at the peak of production ten thousand pairs of traces were completed in a day.

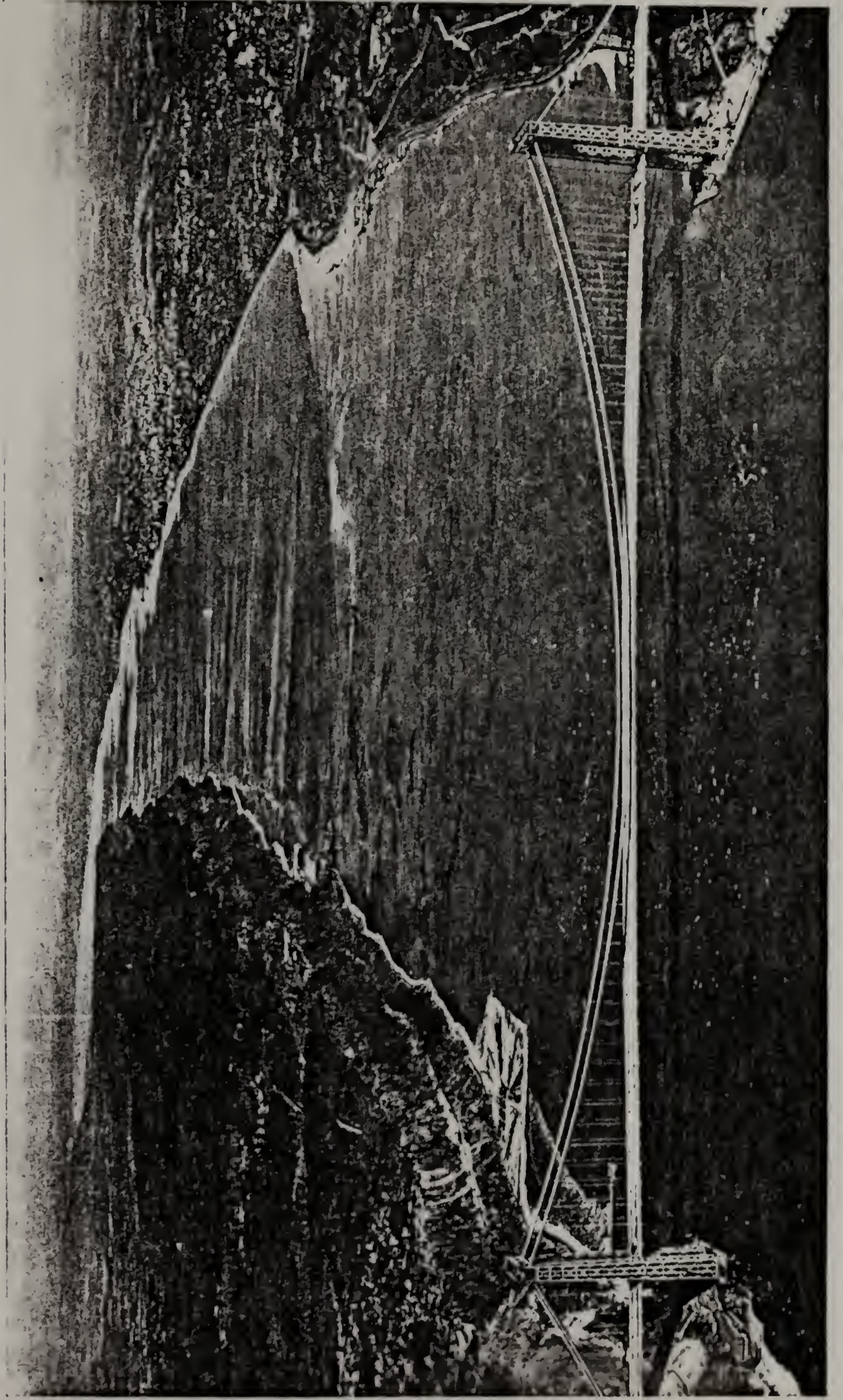
It would be tedious to enumerate the long list of governmental requirements for the Roebling wares which the war brought. It is probably true to say that there was not a single department or bureau of the forces of the Army and Navy which did not look to the Roebblings for their supply of wire rope for one purpose or another. In the Navy Department there were the Ordnance, the Signal Corps, Docks and Yards, Steam Engineering, Construction Aviation, etc. The War Department included the Ordnance, Quartermaster, Signal Corps, Engineer Corps, Army Transport Service, Aircraft, Balloon, and Military Railways. Besides these general uses there was a colossal demand for wire rope for the protection of fleet bases and harbors. For these purposes nearly three million feet of wire rope were required. In addition there was the wire netting which was required for the North Sea mine barrage to trap the enemy's submarines. For this purpose alone nearly eighty-five million feet were absorbed. These ropes had to be cut into proper lengths and prepared with special attachments and all to be delivered within the briefest possible period of time. In addition the Adriatic barrage, since it had to deal with a depth of 3,000 instead of 900 feet, as in the case of the North Sea, required twelve million feet more of wire rope.

When the war came to an end the North Sea mine barrage had to be put out of commission and the mines eliminated. This required nearly a million more feet of rope with the necessary fittings. There are today lying at the bottom of the North Sea

THE ROEBLINGS

more than eighty million feet of perfectly good A No. 1 wire rope, which it is impossible to salvage. The nets, however, answered the purpose for which they were designed, capturing no less than seventeen of the enemy's submarines during the first week after they were placed in position.

In addition to making wire rope for the purposes above specified the Roebblings manufactured immense quantities of steel strand for outpost cables, copper strand, telephone wire, copper wire and sundry other varieties for use at home and abroad. In the manufacture of wire for field telegraph and telephone uses the utmost skill and care are required since nothing short of perfection is requisite for the purpose, else if there be any defect where communication is concerned the most disastrous consequences may follow. All the wire for these uses was made under constant expert inspection and subjected to the most delicate tests.



The George Washington Bridge across the Hudson, the Latest Achievement, Completed in 1931

CHAPTER XXIV

THE GREATEST BRIDGE OF ALL

*The George Washington Bridge, over the Hudson River at
New York, 1931*

At the request of the author, Mr. C. C. Sunderland, chief bridge engineer of the Roebling Company who was in charge of the cable construction of the George Washington Bridge, has graciously furnished the following description of this the latest and biggest of the Roebling-cabled bridges. Accompanying the description is a schedule comparing the dimensions of this bridge with other great suspension bridges, including that recently completed (1926) over the Delaware River between Philadelphia and Camden, by which it will be seen that the George Washington Bridge is double the span and strength of any suspension bridge heretofore erected.

THE Hudson River Bridge, also called the Fort Lee Bridge, and officially named the George Washington Bridge, crossing the Hudson River between Fort Washington Point in New York City and Fort Lee, New Jersey, is located on a line parallel to, and midway between, 178th and 179th Streets, Manhattan.

The Port of New York Authority, created by compact between the States of New York and New Jersey, is constructing the bridge at the direction of the Legislatures of the two States. The Port Authority is authorized and empowered to construct, operate and maintain the bridge.

The construction cost was secured by the proceeds from the sale of \$50,000,000 Port of New York Authority Gold Bonds, and the \$10,000,000 which has been pledged by the States of New York and New Jersey for this project. It is expected that

THE ROEBLINGS

the above moneys will provide all of the funds necessary to permit the bridge to be opened to vehicular traffic.

This is to be a toll bridge. The bonds are secured by a first lien on the revenues which will be derived from the tolls. The moneys advanced by the two States will be repaid to the States together with interest at the rate of 4 per cent.

The Fort Lee Bridge project has a long historical background. This, together with other projects for crossing the Hudson River farther south, goes back nearly fifty years. In 1910 the Interstate Bridge and Tunnel Commission studied the Fort Washington-Fort Lee location and outlined a tentative plan for a cantilever bridge with river piers. Their investigation of foundation conditions, by borings, indicated that no rock bottom was within practical reach over a width of more than 3,000 feet. This discovery indicated that any bridge across the Hudson River within the limits of New York City must consist of a single span of 3,000 feet or more, and this conclusion caused the commission to abandon further consideration of the Fort Lee site. In 1923, Mr. O. H. Ammann, now chief engineer of the Port of New York Authority, made a study of the Fort Lee site and outlined a single-span suspension bridge for this location. In 1925 the Legislatures of New York and New Jersey authorized the Port Authority to build a Hudson River Bridge on a location somewhere between 170th and 185th Streets. Preliminary studies made by the Port Authority in the latter part of 1925 and the early part of 1926 clearly indicated that the project was feasible technically and financially sound. Before the end of 1926 the preliminary studies were advanced sufficiently to permit definite financing of the project.

Formal ground-breaking ceremonies took place on September 21, 1927.

THE GREATEST BRIDGE OF ALL

The completion of this structure will mark an epoch in engineering and construction achievement. Engineering progress usually goes forward cautiously, step by step, but here we see a sudden leap forward into a wholly new range of magnitude. During the forty-three years between the opening of the Brooklyn Bridge in 1883 and the Delaware River Bridge at Philadelphia in 1926, the increase in span length was only 12 per cent. Yet within a short five years after 1926, the Hudson River Bridge with a span length of 3,500 feet—that is, 100 per cent longer span—will be opened to traffic. It will be interesting to note that the engineering reports of proposed bridges across the Hudson River, even as far back as 1894, show that a span length of 4,335 feet was practical from an engineering standpoint, but that the toll revenue would not be sufficient to warrant the building of such a costly bridge. Even in 1910 the traffic studies indicated that the project was not financially sound. Today the automobile has changed the whole situation. Based on a traffic study during the summer and fall of 1925, the total trans-Hudson River traffic between the Battery and Yonkers indicated that the traffic volume in 1932 would be so increased as to justify an estimate of 8,000,000 vehicles crossing the Hudson River Bridge in 1932, and giving a net revenue from tolls of over \$5,000,000. The 1930 traffic study shows that the total trans-Hudson River traffic between the Battery and Yonkers was 25,500,000 vehicles. This is more than double the traffic of 1924 and 30 per cent more than the engineers' estimated traffic for 1930, when preparing the traffic report in 1925.

This great increase of traffic beyond the estimated traffic, together with the actual traffic over the Delaware River Bridge at Philadelphia, which is far exceeding the engineers' estimate for that structure, warrants the belief that the Hud-

THE ROEBLINGS

son River Bridge will likewise carry traffic far in excess of the estimate.

The engineers' estimate for traffic across the Hudson River Bridge for 1954 is over 15,500,000 vehicles and a net revenue of \$13,500,000 for that year. This shows that the estimated traffic in 1954 is practically double that for 1932.

One of the unusual features of this particular bridge is the provisions made so that the capacity can be increased as the traffic grows. When opened to vehicular travel late in 1931, the bridge will have two 29-foot roadways and two sidewalks. Each roadway will accommodate three lanes of traffic. The liberal width of each lane (9 feet 7 inches) will permit high-speed travel. As traffic grows another roadway 30 feet wide will be constructed, providing three additional lanes of traffic. All of these roadways, including the two sidewalks, are on one level, the upper deck of the bridge. When required, a lower deck, nearly 100 feet wide, will be constructed. This will permit the installation of either eight rapid-transit tracks or a combination of four rapid-transit tracks and a four-lane roadway for trucks or buses.

The main supporting members of the bridge—towers, cables and suspenders—are originally constructed for the full capacity of the bridge; therefore the increased capacity can be installed as required without interfering with general traffic. Funds for the construction of this additional capacity will be secured from the toll revenues.

When first opened to traffic, the cost of the bridge in this stage of completion is expected to be within \$60,000,000. The estimated cost of the finished bridge, constructed for the full capacity, is \$75,000,000.

A study of the cross-section of the roadways shows that the designing engineers fully appreciate the trend towards heavier

THE GREATEST BRIDGE OF ALL

vehicles travelling at high speed. The proportioning of parts of the structure are based on the heaviest existing vehicles with liberal allowance for possible future increases, together with the impact effect produced by such vehicles travelling at high speed.

A bridge of this magnitude and costing \$75,000,000 must be constructed on the basis of future needs rather than present requirements. A bridge that would be obsolete in fifty years could not be considered for this project; the bridge must be built to endure, not decades, but centuries. The massive proportions and carrying capacity of the bridge can be visualized by comparison with the Delaware River Bridge at Philadelphia, which today is carrying a vehicular traffic far in excess of any other bridge now in service. The suspended dead load of the mighty bridge is 50 per cent greater per linear foot of the bridge than the Delaware River Bridge, namely 39,000 pounds per linear foot for the Hudson River Bridge and 26,000 pounds per linear foot for the Delaware River Bridge.

Consider what this means—a dead load 50 per cent greater per linear foot, together with a 100 per cent longer span. Is it any wonder that the required strength of the cables for the Hudson River Bridge is three times greater than the Delaware River Bridge, 360,000 tons strength for the one and 120,000 tons strength for the other, and a total weight of cables over 4.4 times the weight of the smaller bridge? The data given indicate the magnitude of the engineering achievement. It is, however, a construction problem of even greater magnitude, which taxes the skill of the contractor to the maximum, especially the cable construction which required the creation of new high standards and the application and improvements of scientific and mechanical investigations, methods and equipment that have assured great safety, efficiency and economy never before

COMPARISON OF SUSPENSION BRIDGES

	BROOKLYN	WILLIAMSBURG	MANHATTAN	BEAR MOUNTAIN	DELAWARE RIVER	MID HUDSON	HUDSON RIVER
<i>Location</i>	<i>East River New York City</i>	<i>East River New York City</i>	<i>East River New York City</i>	<i>Hudson River Bear Mt., N.Y.</i>	<i>Delaware River Philadelphia</i>	<i>Hudson River Poughkeepsie, N.Y.</i>	<i>Hudson River Pt. Washington 179th St. New York City</i>
Date of erection	1870-83	1896-1903	1910-10	1923-24	1922-26	1926-30	1927-31
Length of main span in feet	1,596	1,600	1,470	1,632	1,750	1,500	3,500
Number of cables	4	4	4	2	2	2	4
Number of strands per cable	19	37	37	37	61	19	61
Diameter of cable in inches	15½	18¾	20¾	18	30	16¾	36
Total number of parallel wires in main cables	21,432	30,784	37,888	14,504	37,332	12,160	105,896
Total weight of wire in main cables in tons	3,272	4,344	6,108	1,914	6,626	1,998	28,500
Total length of cables between anchorages in feet	3,578½	2,985	3,224	2,640	3,540	3,287	5,212
Total strength of main cables in tons	44,800	89,200	113,200	47,200	121,000	39,000	360,000
Diameter of individual bridge wire in inches	.187	.192	.195	.195	.195	.195	.195
Height of towers	273'	310'	291'	350'	385'	315'	635'
Number and diameter of suspender ropes at each panel point	1 ⅝" and 1 ¾" diameter	4-1 ¾" diam.	2-1 ¾" diam.	2-2 ¼" diam.	4-2 ¼" diam.	2-1 ⅝" diam.	8-2 ⅞" diam.

THE GREATEST BRIDGE OF ALL

approached in similar work. It marks a very long stride in bridge construction and demonstrates the advance of manufacture and erection fully equal to exacting requirements of engineering progress.

In the design and construction of suspension bridges and bridge cables, uninterrupted since 1849, John A. Roebling and his successors have originated and perfected many features essential to the success and safety of the Hudson River Bridge cable work (the cable construction for this bridge being Roebling's particular responsibility), among them being the following:

- 1: The use of wire spinning wheels
- 2: The aerial cable spinning process
- 3: Tramways for cable wire spinning
- 4: The use of erection footbridges
- 5: A new type of wire spinning wheel and wheel carriage, eliminating the gooseneck that limited spinning speed
- 6: Improved tramway supporting sheaves
- 7: Erection of footbridges by tramway carriages
- 8: Erection of footbridges from mid-span to towers with increased rapidity and safety
- 9: Wire mesh flooring for erection footbridges
- 10: Sectional footbridge cables
- 11: Storm system independent of footbridge
- 12: Suspended compression booms in storm system
- 13: Preliminary straining of footbridge cables and tramway ropes
- 14: Automatic counterweight adjustment for storm system
- 15: Maintenance of uniform cable wire tension by counterweights
- 16: Instantaneous central control of all wire spinning operations

THE ROEBLINGS

- 17: Power-driven and power-braked cable wire reels
- 18: Power adjustment of cable wires
- 19: Stringing cable wires on strand shoes in vertical planes
- 20: Cable wire splices of practically 100 per cent efficiency

With the exception of the first four features, the remaining sixteen listed features were developed for the cable erection of the Hudson River Bridge and were the result of two years' scientific and mechanical investigation in the laboratories of the Roebling Company.

The actual construction of the bridge has followed very closely the engineers' schedule of erection, with the exception of the cable erection contract, which was completed far in advance of the contract requirement. According to the contract, one set of cables (2) was to be finished by December 1, 1930, so that erection of the steel suspended structure could commence at that time, and the second set of cables (2) was to be completed by December 1, 1931. Due to the developed improvements by the Roebling Company, it was possible to complete all cables, ready for the erection of steel suspended structure, on October 28, 1930. That is, the first set of cables was finished over one month ahead of contract and at the same time the second set was completed—thirteen months ahead of contract requirements.

The history of the construction work shows that the New Jersey tower piers were finished June 8, 1928, and the New York tower piers finished July 1, 1928. The construction of the towers commenced on these dates and was completed June 20, 1929. On this latter date the preliminary construction of the main cables commenced and the first footbridge suspension rope was raised to position on July 9, 1929. From this date to October 18, 1929 (the date on which the actual spinning of main cables started), the erection of the footwalks, spinning

THE GREATEST BRIDGE OF ALL

tramways and other operating and handling equipment was accomplished. The last wire in the four main cables was placed on August 8, 1930. The record of constructing in position of 56,600,000 pounds of bridge wire in a period of 294 calendar days will not be exceeded for some time to come.

By October 28, 1930, the compacting of cables, placing of cablebands and suspender ropes was accomplished and erection of steel suspended structure started. The latter operation was completed January 21, 1931, and the placing of the concrete roadways commenced as soon as the weather permitted.

The completion of the concrete roadways in June 1931 permitted the operation of wrapping the main cables to start early in July. This operation and the dismantling of erection footbridges and other equipment will be accomplished before the end of October 1931. On this basis the expectation of opening the bridge to traffic in November 1931 appears to be a safe prediction.

INDEX

INDEX

- ABBOTT, Arthur V., 248
 Abbott, Dr. Charles C., 171
 Aderhold, hotel-keeper, 164
 Adirondack-Florida School, 389
 Alexander, Sergeant, 199
 Alexis, Grand Duke, of Russia, 267
 Alleghany Mountains, portage railway over, 37, 48-9; J. A. Roebling surveys railroad route over, 46
 Allegheny River, bridge over, at Pittsburgh. *See* Pittsburgh-Allegheny Bridge
 Allison, Margaret G. *See* Roebling, Mrs. Ferdinand William
 Allison, Thomas S., 294
American Railroad Journal, 62, 65, 70, 71
 Ammann, O. H., 400
 aqueducts. *See* suspension aqueducts
 Arthur, Chester Alan, President of the United States, 252, 254
August Eduard, the, 22, 28, 30
- BAEHR, Ferdinand, Saxonburg colonist, 22, 27-8, 160-1, 164
 Baird, David, Sr., 302
 Banks, General N. P., 201, 202, 218
 Bear Mountain Bridge, 271-2, 380-2, 404; cables, 378-9, 382, 404
 Beasley, Mercer, 107
Beecher's Magazine, 96
 Berlin, University of, 12
 Bernardsville, New Jersey, home of J. A. Roebling, II, 276, 384
 Bernigau, cabinet-maker, 162, 163
 Berry, General, 209
 Bessemer steel, replaces Swedish and American iron, 304, 335, 337; replaced by open-hearth steel, 346
 "Billy Sunday," dog belonging to W. A. Roebling, 272, 274
 Bleichert tramway, 339
- Bloomsbury Court, built by William Trent, 150
 Bowman, Margaret Roebling, 393
 Bowman, Robert T., 393
 Bowman, Mrs. Robert T. (Anne Allison Perrine), 393
 Bramshall, Captain, 208, 209, 222
 Bremen, 28, 29
 bridges. *See* suspension bridges *and* names of individual bridges
 Briggs, Frank O., 301-2, 335, 353
 Brooklyn, W. A. Roebling's residence in, 139, 240, 244, 254; celebration of opening of Brooklyn Bridge, 250-3. *See also* Brooklyn Bridge
 Brooklyn Bridge, 131-9, 236-59; J. A. Roebling's part in building, 93, 130, 132-3, 134-9; W. A. Roebling's part in building, 15, 130, 236, 239-48, 273; cost of building, 135-6; construction of the caissons, 240-3; engineers and foremen, 248; fatal accidents, 248-9; wages of bridge workers, 249; measurements, 249-50, 404; ceremonies at opening of bridge, 250-3; described by Montgomery Schuyler, 254-6; bibliography, 237, 256-9; cables, 349, 350, 351, 375-6, 404
 Buck, L. L., engineer of Williamsburg Bridge, 349, 350
 Burnside, General A. E., 226, 227
 Butler County Historical Society, 156
- CABLES, hempen, used on portage railways, 48, 49-50; replaced by wire rope, 50-1; opinions regarding use of wire cables, 51-4; transatlantic, J. A. Roebling's views regarding, 87-8; parallel wire-cable spinning, 376-8; latest methods of cable construction, 378-9, 405-6. *See also* wire rope and names of individual bridges
 Cadwalader, Richard McCall, 315

INDEX

- Cadwalader, Mrs. Richard McCall (Emily Roebling), 143, 315
- Cadwalader Park, Trenton, J. A. Roebling monument in, 15, 142-4
- Camden and Amboy Railroad, 76, 106-7, 360
- Camden-Philadelphia Bridge. *See* Delaware River Bridge, at Philadelphia
- Captains of the Civil War*, quoted, 192
- Carr, Charles, 347
- Central Park, New York, removal of Cleopatra's Needle to, 312-13
- Chamberlain, L., letter to J. A. Roebling, 54
- Chase National Bank, New York, 391
- Cheney, Mr., of Pittsburgh, 214
- cholera epidemic, in Muhlhauseu, 40; at Niagara Falls, 94-6
- Cincinnati-Covington Bridge, built by J. A. Roebling, 93, 109-10, 125-8, 137; dimensions, 126, 128, 130, 134, 138; W. A. Roebling's part in building, 233-4, 235, 236, 239
- City Hall, Trenton, F. W. Roebling chairman of building commission, 293
- Civil Engineers, American Society of, 244
- Civil War, J. A. Roebling's activities during, 93, 109; W. A. Roebling's service in, 93, 189-232
- Clark, James, letter favoring use of wire cables on inclined planes, 53-4
- Cleopatra's Needle, C. G. Roebling's part in its removal to New York, 312-13
- Cleveland, Grover, 252
- Clowry, Robert, 387
- Cold Spring, New York, 233; W. A. and Emily Warren Roebling buried at, 276-7
- Cole, David, principal of Trenton Academy, 170
- Collingwood, Francis, 248
- Collins, Isaac, 37n.
- Collins, Mrs. Isaac, sells land to J. A. Roebling, 37-8
- Columbian College, now George Washington University, 290
- Company A, National Guard, New Jersey, 189, 190, 200-1
- Comstock, Lieutenant C. B., 222
- Cook, George Rea, 393
- Cook, Mrs. George Rea (Margaret Roebling White), 393
- Cook, Margaret Allison, 393
- Cooper, Lucia W. *See* Roebling, Mrs. John August, second wife
- Cooper, Peter, head of Trenton Iron Company, 59-60, 73-4, 75
- Copeland, Mr., New York agent, 99
- Corson, Dr., 227, 228
- Couper, William, sculptor of J. A. Roebling statue, 143
- Covington Bridge. *See* Cincinnati-Covington Bridge
- Cummins, Robert B., senator, 263
- Cunningham, Alex., of Glasgow, 212
- Cunningham, G. B., of Worcester, 334
- DANIEL WEBSTER, the, 227
- Davis, Jefferson, 229-30
- Dayton, William L., 171
- Dayton, William L., Jr., 171
- Delaware and Hudson Canal Company, 51, 64, 72, 100, 103
- Delaware and Raritan Canal, 72, 76
- Delaware River Bridge, at Philadelphia, 399, 401, 403, 404
- Dickens, Charles, account of journey over Alleghany Mountains, 49
- Dietleyn, J. F. W., professor at Polytechnic Institute, Berlin, 12
- Dobie, Mr., of Pittsburgh, 204, 235
- Donnelly, Frederick W., mayor of Trenton, New Jersey, 386
- Dryden, John F., senator, 301-2
- Dubail, Madam, innkeeper, 162
- Dunbar, Seymour, *History of Travel in America*, quoted, 48-9
- Duquesne, Fort, 180
- EARLY, General Jubal A., 230
- East River Bridge. *See* Brooklyn Bridge
- Edson, Franklin, mayor of New York City, 252
- Eisenhardt, brother-in-law of Baehr, 161

INDEX

- Ellet, Charles, Jr., rival of J. A. Roebling in building suspension bridges, 54, 82-3; letters regarding suspension bridges and cables, 55-6; builds Fairmount Bridge over Schuylkill, 57-8, 117; his bridge at Wheeling, West Virginia, repaired by J. A. Roebling, 117-18; fails to complete Niagara Falls Bridge, 118-19, 122
- Emory, A. H., 174
- Engineers' Club of New York, 315
- Equitable Life Assurance Society, 294
- Erfurt, 3, 11, 12
- Erie Canal, 43
- Eschwege, 11
- Estabrook, Blanche. *See* Roebling, Mrs. Karl Gustavus
- Estabrook, Henry D., 387; speaks at unveiling of J. A. Roebling monument, 142, 144
- Etzler, Y. A., 21, 24
- Ewing Cemetery, Ewing, F. W. and K. G. Roebling buried in, 295, 386
- Eytelwein, J. A., professor at Polytechnic Institute, Berlin, 12
- FAIRMOUNT Bridge, over Schuylkill River, built by White and Hazard, 117; built by Charles Ellet, 57-8, 117
- Farrington, E. F., 248
- Farrow, Cornelia Witsell. *See* Roebling, Mrs. Washington Augustus, second wife
- Farrow, John B., 276, 278
- Farrow, Mrs. John B., 276
- Faust, Albert Bernhardt, *German Element in the United States*, quoted, 18
- Fessenden, William P., Secretary of the Treasury, 112
- Field, Cyrus W., 87
- Finley, James, 116
- First-Mechanics National Bank, Trenton, 293, 391
- Fisher, Clark, 179-80, 230n.
- Fisher, Mark, 230n.
- Fisher, Otis, 230
- Fisk, Jonathan, 99, 100
- Fitch, John, 75
- Floyd, J. B., 213
- Ford, W. E., article in *American Journal of Science*, 266
- Fort Duquesne, 180
- Fort Lee Bridge. *See* George Washington Bridge
- Franklin Furnace, New Jersey, roeblingite found only at, 267
- Freeport, on Pennsylvania Canal, 46, 72, 159, 162, 179
- Frémont, General John C., 81
- GANDY, William H., 146
- Gates, Mr., 352
- Geib, Mr., 178
- George Washington Bridge, 399-407; construction cost, 399-400, 402; carrying capacity, 401-3; cables, 403, 404-6
- George Washington University, formerly Columbian College, 290
- German immigration to United States, 16-20, 27, 31
- Germania. *See* Saxonburg
- Germany, Roebling family in, 5-9; conditions in early nineteenth century, 14, 17, 19, 20, 31, 32, 47; emigration from, 16-20, 27
- Gettysburg, W. A. Roebling at Battle of, 191-2
- Gill, E. H., engineer of Sandy and Beaver Canal, 44
- Gorringe, H. H., 312-13
- Gotha, 3
- Grabe, August, makes contract with Roebling brothers, 22-4
- Great Central Railroad. *See* Pennsylvania Railroad
- Greensburg Bridge, erected by James Finley, 116
- HACKSTEIN, W., 24
- Hagen, Westphalia, branch of Roebling family living in, 6
- Hagner, Alexander B., 387
- Hagner, Mrs. Alexander B. (Caroline Roebling), 387
- Hall, Caldwell K., 218
- Hall, Lieutenant, 213
- Halleck, General H. W., 218, 224

INDEX

- Harris, Mr., employee of Roebling Company, 303
- Hazard Company, competitor of Roebling Company, 304
- Hegel, Georg Wilhelm Friedrich, J. A. Roebling influenced by, 12-13
- Helmbold, Ernst, 164
- Helmbold family, 165
- Henne, German teacher, 160
- Henry, Samuel, 75
- Henry Barclay*, the, 28
- Herting, Ernst, Saxonburg colonist, 22, 41, 156-7
- Herting, Mrs. Ernst (Catherine Miller), 157, 163
- Herting, Johanna. *See* Roebling, Mrs. John August
- Herting, Leonora. *See* Riedel, Mrs. Julius
- Hewitt, Abram S., 73, 74, 252; speech at opening of Brooklyn Bridge, quoted, 132, 135-6, 245-6, 248
- Hildenbrand, William, assistant engineer on Brooklyn Bridge, 248, 334, 339; work with Roebling Company, 334, 339, 347, 349
- Himmelwright, Mr., 353
- Hochaut, *Chronicle of Eschwege*, J. A. Roebling's sketch of city in, 11
- Hollidaysburg, 48, 49, 51
- Hook, Mrs. Cornelius W., 315, 327
- Hooker, General Joseph, 209, 211, 213, 223
- Houston, Major, 217, 218
- Houten, Colonel, letter to Charles Swan, 220-1
- Hudson River Bridge. *See* George Washington Bridge
- Hunt, William Edgar, sells land to J. A. Roebling, 75-6, 383
- Hunter, Captain, inventor of submerged propeller, 59
- hydropathy, J. A. Roebling's interest in, 95, 166, 167; at Philipsburg, 180
- IMMIGRATION, German, to the United States, 16-20, 27, 31
- inclined planes. *See* portage railways
- Interstate Bridge and Tunnel Commission, 400
- Inter-State Railways Company, 293
- Iron and Steel Institute, American, 385, 395
- iron industry in Trenton, 73-5
- JARVIS, Charles Henry, 147
- Jarvis, Mrs. Charles Henry (Josephine Roebling), 147
- Jena, 3, 5
- Johnson, Jeremiah, comments on practicability of bridge over East River, 131
- Johnstown, 48
- Journal of Commerce*, J. A. Roebling's letters in, 87-8, 132
- KELSEY, Henry C., 340
- Kentucky River Bridge, 93-4, 124-5
- Kerney, James, 301, 390
- Killaly, Hamilton H., 124
- Kingsley, William C., 133, 252
- Kinkora, Roebling plant at, 347, 358, 360, 361, 368, 369, 372-3. *See also* Roebling, New Jersey; Roebling, John A., Sons Company
- Knoch, Amelia Roebling, 166
- Knoch family, blacksmiths, 166
- Koch, Dr., 165-6
- Kuser, Colonel A. R., 301
- LAMB, Saxonburg colonist, 166
- Lange, Carl, 84
- "Latin farmers," 16-17, 19. *See also* German immigration to United States
- Lawrenceville School, 384
- Lehigh University, 389
- Lentz, Major Carl, 194
- Lexington and Danville Railroad, 106
- Lexington and Southern Kentucky Railroad, 124
- Lies, Ludwig, friend and tutor of J. A. Roebling, 11
- Lincoln, Abraham, 113, 114, 188, 189, 196-7
- Littlejohn, Bishop, 252
- Lotus Club, of Trenton, 317
- Low, Seth, mayor of Brooklyn, 252

INDEX

- Lutteroth, Dr. Ascan W., 8
 Lyman, Colonel Theodore, *Meade's Headquarters*, quoted, 194-6
- MCCLELLAN, General G. B., 201, 202, 213, 221
 McClure, Judge, of Pittsburgh, 37
 MacDonald, Charles, 174
 McDowell, General Irvin, W. A. Roeb-
 ling on staff of, 190, 222
 McIlvaine, Edward S., 383
 McIlvaine, Margaret Shippen. *See* Roeb-
 ling, Mrs. John Augustus, II
 McNally, George W., 248
 Manhattan Bridge, over East River, 351,
 364, 379, 404
 Martin, Charles C., 248
 Meade, General G. G., 191, 192, 193,
 194-5, 196
 Mechanics and Manufacturers Bank,
 Trenton, 99-100
 Mechanics and Metals Bank, of New
 York, 293
 Mechanics National Bank, of Trenton,
 293
 Meigs, General Montgomery C., 214,
 215, 221, 223, 226-7
 Meissner, Carl, 9
 Meissner, Mrs. Carl (Friederike Amalia
 Roebing), 9, 40-1
 Mercer Automobile Company, 293
 Mercer Cemetery, Trenton, 140
 Metcalf, Joseph P., 391
 Metcalf, Mrs. Joseph P. (Celia Fletch-
 er), 391
 Metcalf, Ruth. *See* Roebing, Mrs. Fer-
 dinand William, Jr.
 Methfessel, Anton Gottlieb, 147, 325
 Methfessel, Mrs. Anton Gottlieb (Laura
 Roebing), 147, 325
 Meyer, Christine Friederike. *See* Roeb-
 ling, Frau Heinrich Wilhelm
 Mid-Hudson Bridge, at Poughkeepsie,
 404
 Miller, Catherine. *See* Herting, Mrs.
 Ernst
 Mineralogical Club of New York, 264
 Mineralogical Society of America, 264
- Mining and Metallurgical Engineers,
 American Institute of, 314-15
 Minor, D. K., letter to J. A. Roebing,
 59-60
 Monongahela Bridge, at Pittsburgh, 63-
 4, 119-20, 137, 186
 Moore, Kenneth W., 393
 Moore, Mrs. Kenneth W. (Margaret
 Perrine), 393
 Morgan, J. P., 191
 Morris, Robert, 38
 Morris, W. E., letters regarding use of
 wire rope on inclined planes, 51-3
 Morris Canal, 49, 51, 103, 179
 Mueller, Friederike Dorothea. *See* Roeb-
 ling, Frau Christoph Polycarpus
 Muhlhausen, Thuringia, birthplace of
 J. A. Roebing, 3, 5; of J. A. Roebing,
 II, 15, 234, 383; cholera in, 40; de-
 scription of, 3-5; emigration from,
 20-22, 28, 39-40, 156; gift to F. W.
 Roebing, Jr., 29; honors J. A. Roeb-
 ling, 15, 142; in Napoleonic wars,
 4-5; liberal spirit in, 14; receives
 gift from J. A. Roebing, 15; Roeb-
 ling family in, 5-11
 Murphy, Henry C., 136
 Murphy, Captain William R., 208
- NAPOLEONIC wars, Muhlhausen during
 the, 4-5
 National Copper Bank, of New York,
 293
 National Guard, New Jersey, Company
 A, 189, 190, 200-1
 Neher, cornetist, 164
 New Harmony, Indiana, 28
New Jersey Gazette, 37n.
 New Jersey Steel and Iron Company, 73
 New Jersey Wire Cloth Company, 293,
 314, 334-5, 352, 353
 New Lisbon, Ohio, 46
 New Orleans, 33, 45, 182
 New York Bridge Company, 133, 140
 New York City, part in financing Brook-
 lyn Bridge, 134-6. *See also* Brooklyn
 Bridge
New York Medical Journal, letter of
 Dr. R. J. Rogers in, 95

INDEX

- New York Public Library, 237, 256
New York Railway Journal, articles of
 J. A. Roebling in, 59, 63-4
Newark Evening News, 302
 Niagara Falls Bridge, begun by Ellet,
 118-19, 122; completed by J. A. Roeb-
 ling, 86, 88, 93, 94, 119-24, 126-7,
 137-8, 172, 374; cholera epidemic dur-
 ing building of, 94-6
- OBELISK in Central Park. *See* Cleopatra's
 Needle
 "obiter dicta," of W. A. Roebling, 279-
 85
 O'Brien, Mrs. Arthur, 387. *See also*
 Roebling, Mrs. Karl Gustavus
 Ohio River, bridge over, at Wheeling,
 West Virginia, 117-18
 Oil City Bridge, designed and built by
 C. G. Roebling, 312
Olden Time, the, 62
 open shop, observed by Roebling Com-
 pany, 151, 366
 Ormsby, Sarah Mahon. *See* Roebling,
 Mrs. Charles Gustavus
 Orphans' Farm School, Zelenople, 146
 Orr, William, superintendent of New
 Jersey Wire Cloth Company, 334, 352
 Otis Elevator Company, 293, 351
- PAINE, Colonel, 338
 Panic of 1857, J. A. Roebling's letters
 during, 98-104
 Parkersburg Bridge, over Ohio River,
 380
 patents, taken out by J. A. Roebling,
 89-92
 Payne, William H., 248
 Pennsylvania Canal, 37, 43, 72; J. A.
 Roebling's connections with, 45-6,
 61-2, 100, 101, 103. *See also* portage
 railway
 Pennsylvania Railroad, 43, 46, 234, 316,
 360, 368; J. A. Roebling forecasts
 future of, 65-71
 Perdicaris, G. A., 171
 Perdicaris, Ion Hanford, 171
 Perrine, Anne Allison. *See* Bowman,
 Mrs. Robert T.
 Perrine, Frederick A. C., 295, 393
 Perrine, Mrs. Frederick A. C. (Margaret
 Johanna Roebling), 294, 295, 392-3
 Perrine, John Augustus Roebling, 393
 Perrine, Margaret. *See* Moore, Mrs.
 Kenneth W.
 Philadelphia, J. A. Roebling's first
 impressions of, 30-1, 32-3; in rela-
 tion to Great Central Railroad, 65-71
 Philadelphia Polytechnic Institute, 290
 Philipsburg, hydropathic cure at, 180
 Phoenix Iron Company, 75, 313
 Pittsburgh, 38, 40, 62, 107, 160; trans-
 portation between Philadelphia and
 P., 37, 43, 48-50, 65, 69, 71, 72; bridges
 built by J. A. Roebling at, 63-4, 119-
 20, 129, 137; W. A. Roebling attends
 school in, 160, 161-2; his impressions
 of, 176-7, 179-80, 181-2, 184
 Pittsburgh-Allegheny Bridge, erected
 by J. A. Roebling, 98, 104, 107, 108,
 129, 137, 176, 239; description of, 129;
 letters of W. A. Roebling regarding,
 181, 182-7
 Pittsburgh Infirmary, 146
 Polycarp, Saint, Bishop of Smyrna, 5
 Pope, General John, W. A. Roebling on
 staff of, 190
 Pope, Thomas, 131
 Port of New York Authority, 399, 400
 portage railways, 48-50, 51-4
 Prime, New York historian, quoted,
 131-2
 Princeton University, 384, 392, 393
 Probasco, Samuel R., 248
 Public Service Corporation of New Jer-
 sey, 293
- RAISULI, Moroccan bandit, 171
 Rathe, B., 24
 Rebeling, Nicholas. *See* Roebling,
 Nicholas
 Regnitz River, bridge over, at Bam-
 berg, studied by J. A. Roebling, 13-14
 Rensselaer Polytechnic Institute, 104,
 172, 260, 310; W. A. Roebling com-
 ments on severity of course, 173-4;
 bequests from Roebling family, 174,
 278

INDEX

- Rhule, Jonathan, 82-3, 204
- Riedel, Edmund, 102, 140, 158, 235, 303
- Riedel, Julius 158-60, 164, 177
- Riedel, Mrs. Julius (Leonora Herting), 158
- Ripley, Dorothy. *See* Roebbling, Mrs. Robert Clowry
- Riverview Cemetery, Trenton, J. A. Roebbling and wife and C. G. Roebbling buried in, 140, 315
- Robinson, Mr., cable inspector, 351
- Rochester, Lockport and Niagara Falls Railroad, 86
- Roebbling, Allison. *See* Van der Elst, Baroness Joseph
- Roebbling, Amelia. *See* Knoch, Amelia Roebbling
- Roebbling, Augusta Henrietta. *See* White, Mrs. William Townsend
- Roebbling, Caroline. *See* Hagner, Mrs. Alexander B.
- Roebbling, Charles Gustavus, birth, 157, 310, 324; early education, 310; attends boarding-school on Staten Island, 310, 325; graduates from Rensselaer Polytechnic Institute, 149, 174, 310, 326; inherits interest in firm, 145, 146, 310, 327; devotes himself to engineering and manufacturing end of business, 297, 304, 310-12, 327, 332-66; becomes president of company, 311, 314; builds Oil City suspension bridge, 312; builds cables for Williamsburg Bridge, 312, 328, 349-52; his part in removal of Cleopatra's Needle to New York, 312-13; builds town of "Roebbling," 307, 313, 359-66, 367-73; musical ability, 314, 316, 321, 325; his collection of orchids, 314, 316, 321; grief over death of sons, 314, 327; interest in church, 314; member of State Legislature, 314; member of Trenton Water Board, 314; president of New Jersey Wire Cloth Company, 314; member of American Institute of Mining and Metallurgical Engineers, 314-15; member of Engineers' Club of New York, 315; death, 273, 315, 324, 384; marriage, 315; death of wife, 315, 327; children, 143, 315, 327; grandchildren, 315; his estate, 315-16; personal characteristics, 316-18, 321-4, 326, 327-8, 336, 337, 365-6; dislike of letter-writing, 317, 328; attitude toward employees, 318-20, 327-8, 371; tribute to his personality, 320-4; religious views, 323; memoir written by W. A. Roebbling, 310, 324-8; selects middle name, 325; builds new rolling mill, 332; experiments with galvanized wire, 332-3; builds new wire mill, 333-4; erects wire cloth factory, 334; experiments with Bessemer steel, 335-6; management of strikes, 336-7, 345; builds new wire rope factory and machines, 338-9; begins manufacture of copper wire, 340-2; builds braiding shops, 341-2; erects building for insulated wire business, 343; builds new rolling mill, 343-5; experiments with lead tempering, 345-6; builds new wire mill, 346-7; new wire rope shop, 347-8; interested in Roebbling Construction Company, 352-3; rebuilds Buckthorn plant, 355; builds new rope shop, 355; activities during World War, 356-8; an expert metallurgist, 366
- Roebbling, Mrs. Charles Gustavus (Sarah Mahon Ormsby), 315, 327
- Roebbling, Christoph Polycarpus, father of J. A. Roebbling, 5-6, 7, 8-10
- Roebbling, Frau Christoph Polycarpus (Friederike Dorothea Mueller), 5, 8-10; death, 40
- Roebbling, Donald, 278, 384
- Roebbling, Edmund, birth, 94, 147, 157; receives interest in firm, 145-6; retires from business because of ill health, 147; death, 147; value of estate, 147
- Roebbling, Elvira. *See* Stewart, Mrs. John H.
- Roebbling, Emily. *See* Cadwalader, Mrs. Richard McCall
- Roebbling, Ernst Adolph, 8
- Roebbling, Ernst Wilhelm, 8

INDEX

- Roebing, Ferdinand William, memoir written by W. A. Roebing, 289, 303-9; birth, 157, 290; attends Trenton Academy, 171, 290; studies at Philadelphia Polytechnic Institute, 290; student at Columbian College, 290, 292; letters to Swan from Washington, 290-1; first sales for the company, 178-9, 290; enters wire rope department of mill, 149, 292; father refuses consent to his enlistment, 292, 303; secretary and treasurer of Roebing company, 146, 292, 311; important directorships held by him, 293, 294, 299; trustee of Trenton Public Library, 293; member of Trenton Country Club, 293; chairman of building commission for Trenton City Hall, 283; delegate to Republican National Conventions, 293-4, 306; his favorite sports, 294; his fondness for flowers, 98, 294; farm near Trenton Junction, 294; marriage, 294; children, 294, 392-3; death of wife, 295; his grandchildren, 295, 393; death, 295; business ability, 295-8, 303, 306, 307; growth of Roebing company during his management, 295-7, 304-6, 307-8, 311, 312; indifference to public opinion, 298-9; political arbiter in local affairs, 300-2, 306; refuses nomination for U.S. senator, 301-2; personal characteristics, 298-9, 302-3, 306-8; relations with employees, 302, 306; success in selling telegraph wire, 333; interested in wire cloth business, 334-5; in magnet wire business, 342; loses heavily in incandescent light business, 342-3
- Roebing, Mrs. Ferdinand William (Margaret G. Allison), 294, 295
- Roebing, Ferdinand William, Jr., receives copy of J. A. Roebing's diary from Muhlhausen, 29; birth, 389; education, 389; enters engineering department of Roebing industry, 294, 390; work praised by W. A. Roebing, 390; offices held by him in company, 389-91; member of Trenton Water Board, 391; a presidential elector, 391; bank director, 391; awarded Trenton Times Civic Cup, 391; marriage, 295, 391; his home in Trenton, 391; in Spring Lake, 391; interest in Trenton's civic and philanthropic activities, 392; sons, 295, 392
- Roebing, Mrs. Ferdinand William, Jr. (Ruth Metcalf), 295, 391-2
- Roebing, Ferdinand William, III, 392
- Roebing, Friederike Amalia, 9. *See also* Meissner, Mrs. Carl
- Roebing, Hanns Jacobus, son of Jacobus Roebing, 6
- Roebing, Harrison Ormsby, 315, 327
- Roebing, Heinrich Wilhelm, 7-8
- Roebing, Frau Heinrich Wilhelm (Christine Friederike Meyer), 8
- Roebing, Helen. *See* Tyson, Mrs. Carol Sargent, Jr.
- Roebing, Henry Charles Polycarpus, son of Karl Friederich Roebing, 184-5
- Roebing, Hermann Christian, grandfather of J. A. Roebing, 6-7
- Roebing, Frau Hermann Christian (Maria Elizabetha Weymar), 6-7
- Roebing, Hermann Christian, II, brother of J. A. Roebing, 9
- Roebing, Jacobus, son of Nicholas Roebing, 6
- Roebing, Jacobus Philip, son of Hanns Jacobus Roebing, 6
- Roebing, Johann August. *See* Roebing, John August
- Roebing, Johanna, daughter of Heinrich Wilhelm Roebing, 8
- Roebing, John A., Sons Company, incorporated, 144, 146, 311; relation of employees to company, 150-1, 370-1; observance of open shop, 151, 366; branch offices and warehouses, 236, 346; F. W. Roebing's part in building the business, 295-7, 304-6, 307-8, 312; C. G. Roebing's conduct of the business, 311-13, 327-8, 332-66, 369, 371; W. A. Roebing's account of the industry, 147-9, 330-66; refuses offer

INDEX

of United States Steel Corporation, 352; loses large sum to Roebling Construction Company, 353; activities during World War, 356-8, 394-8; town of Roebling founded, 359-61; plant built at Roebling, 360-6; policy of company at Roebling, 370-1; builds cables for George Washington Bridge, 399, 405-7; BUCKTHORN PLANT: manufacture of enamelled wire at, 342; destroyed by fire, 354-5; partially rebuilt, 355; rope shop built, 355, 356; used for making wire rope during World War, 357; ROEBLING PLANT: needed for expansion of business, 359, 367, 368; selection of site, 359-60, 367-8; laying-out of plant, 307, 312, 360-1, 369; steel furnaces built, 361-2, 365; rod mill a great achievement, 362-3; wire mills, 363-4; galvanizing and tempering shops, 364; wire cloth business removed to, 365; recent additions to plant, 373. *See also* Roebling, New Jersey. TRENTON PLANT: first wire rope works in Trenton, 84-5; growth of industry (1850-70), 89, 108-9, 144-5, 147-9, 303-4; new wire rope machines, 304; new rolling mill, 305, 332; manufacture of galvanized wire, 304, 332-3, 337-8; of telegraph wire, 333; new wire mill on Elmer Street, 305, 333-4; manufacture of binder wire, 334; wire cloth business, 334-5; wire nail business, 335; flat wire business, 307, 335, 358-9; use of Bessemer steel, 335-6, 337; strikes, 151, 336-7, 344-5, 366; new rope shop, 338; "Saw Works" purchased, 339; manufacture of wire rope tramways, 339; of fence wire, 340; of copper wire, 340-2; fires, 313, 341, 342, 345, 347, 348, 355-6, 358; braiding shops built, 341-2; magnet wire business, 342; growth of insulated wire business, 343; new rod-rolling mill, 343-5; new wire mill, 346-7; new wire rope shop, 347-8; builds cables for Williamsburg Bridge, 349-52

Roebling, John August, ancestry, 5-8; birth, 3, 5; parents, 5-6, 8-10, ambitions of mother, 10; education: in Muhlhausen, 11; with Lies at Eschwege, 11; under Dr. Unger at Erfurt, 11-12; at Royal Polytechnic Institute, Berlin, 8, 11, 12, 13; at University of Berlin, 12, 35; friendship with Stuebler, 12; influenced by Hegel, 12-13; "Roebling's Theory of the Universe," 13; builds roads in Westphalia, 13; studies suspension bridge over Regnitz River, 13-14, 54; an ardent liberal, 14; honored by town of Muhlhausen, 15; gift to the town, 15; decides to emigrate to America, 20-1, 47; organizes party of colonists, 19, 20-2, 25-8; contract with Grabe, 22-4; diary of voyage to America, 22, 28-34; impressions of Philadelphia, 30-1, 32-3; comments on American life, 28-9, 30-4; attitude toward slavery, 33-4, 47; high type of immigrant, 35-7; as a pioneer farmer, 35-7, 42-3; buys land in Butler County, Pennsylvania, and founds village of Saxonburg, 37-9; urges friends in Muhlhausen to migrate to Saxonburg, 39-40; death of mother, 40; marriage, 41, 156; children, 41, 147, 156, 290, 310; temporary employment as a State engineer, 43; builds dams and locks on Sandy and Beaver Canal, 44; letter to E. H. Gill, 44; plans for improving navigation of large rivers, 44-5; for improving channel of Mississippi, 45; for improving railroad construction, 45; works on feeder of Pennsylvania Canal, 45-6; surveys railroad route over Alleghany Mountains, 46; works on canal at New Lisbon, Ohio, 46; salary, 46; becomes a naturalized citizen, 46-7; makes first wire rope for use on portage railways, 48, 50-1; letters from W. E. Morris, James Clark and L. Chamberlain regarding use of wire cables, 51-4; letter to Ellet regarding suspension bridges,

INDEX

54-5; Ellet's replies, 55-6; correspondence with Andrew Young regarding Fairmount Bridge, 57-8; letters from Schlatter, 58-9; article on wire rope in *New York Railway Journal*, 59; letter from D. K. Minor, 59-60; builds wooden aqueduct over Allegheny River, 61-2, 77; article in *American Railroad Journal* on aqueduct, 62; erects his first suspension bridge over Monongahela, 63-4; description of bridge in *New York Railway Journal*, 63-4; constructs suspension aqueducts on Delaware and Hudson Canal, 64; forecasts future of Pennsylvania Railroad system, 65-71; selects Trenton as a site of wire rope factory, 60, 73-5; purchases land for plant, 75-6, 383; places Charles Swan in charge of construction work, 77-8; letters to Swan regarding running of business, 78-80, 82-4; personal characteristics, 78, 79-81, 141, 144; instructions about digging a well, 82, 83; warns Swan against employing a Jonathan Rhule, 82-3; arranges to hire German wire-drawers and machinists, 83-4; prohibits smoking at works, 84; wire rope factory begins operations, 84-5; accident to his hand, 85-6; appointed chief engineer, Niagara Falls Bridge, 86, 119; speaks at meeting of Trenton Philosophical Society, 86; contribution for poor at Trenton, 87; letter in *Journal of Commerce*, giving his views on transatlantic telegraph, 87-8; family settles in Trenton, 77, 83, 88, 167; patents taken out by him, 89-92; letters to Swan, 93-4; birth of fourth son, 94; activities during cholera epidemic at Niagara Falls, 95-6; faith in hydropathy, 95, 112, 166, 167; Niagara Falls Bridge opened, 96-7; 122-4; new home in Trenton, 97-8; letters to Swan, during Panic of 1857, 98-104; letters of 1858, 104-6; interested in English process of converting iron wire into steel

wire, 105-6; one of purchasers of Lexington and Danville Railroad, 106; letters of 1859-60, 106-8; controversy with Camden and Amboy Railroad, 106-7; completes Pittsburgh-Allegheny Bridge, 108, 129, 176; attitude toward Civil War, 109, 114; letters of 1863-65, 109-14; resumes work on Cincinnati-Covington Bridge, 109-10; business policies, 111-12; death of wife, 41, 113; first to construct railway suspension bridge, 117; repairs bridge at Wheeling, West Virginia, 118; methods differ from those of Ellet, 118; views on railway suspension bridges, 119-22, 127-8; his *Memoir of the Niagara Falls and International Suspension Bridge*, 123, 130; work on bridge over Kentucky River, 124-5; completes Cincinnati-Covington Bridge, 125-8; tribute to his scientific knowledge, 129-30; first to suggest feasibility of Brooklyn Bridge, 132-3; appointed chief engineer, 134-5; plans approved by board of consulting engineers, 137-8; sudden death, 139-40; funeral, 140; tributes to his genius, 140-2; monument in Cadwalader Park, 15, 80, 142-4; value of estate, 144; status of industry at his death, 144-5, 147-9; will and benefactions, 145-6; second wife, 145; parental discipline, 167, 168-9, 172; dislike of Democratic party, 178; encourages son Washington to enlist, 188-9; opposes Ferdinand's enlistment, 292, 303; religious views, 325; musical ability, 36, 80, 164, 325-6; his engineering policy, 374; inventor of aerial spinning process for wire cables, 376; descendants living in 1931, 393

Roebling, Mrs. John August (Johanna Herting), first wife of John A. Roeb-ling, 22, 156, 157, 325; children, 41, 147; death and burial, 41, 112-13, 114, 140

Roebling, Mrs. John August (Lucia W.

INDEX

- Cooper), second wife of John A. Roebling, 145
- Roebling, John Augustus, II, birth, 234, 383; graduated from Rensselaer Polytechnic Institute, 260, 383; marriage, 76, 383; interest in scientific investigation, 383; children, 383-4; death of wife, 384
- Roebling, Mrs. John Augustus, II (Margaret Shippen McIlvaine), 76, 276, 278, 383-4
- Roebling, Joseph Metcalf, 392
- Roebling, Josephine. *See* Jarvis, Mrs. Charles Henry
- Roebling, Karl Friederich, brother of John A. Roebling, birth, 9; aids brother in organizing party of colonists, 9, 20-4, 25-8, 34-5; signs contract with Grabe, 22-4; illness, 37; his part in founding Saxonburg, 37-41; marriage, 41; death, 9, 41; children, 41, 166, 184
- Roebling, Karl Gustavus, birth, 384; education at State Model School and Lawrenceville, 384; student at Princeton University, 384; enters employ of Roebling company, 384; becomes general sales manager, 384, 388; travels extensively, 384, 385; becomes second vice-president, 384; president, 365, 384, 388; activities during World War, 385, 395; health shattered, 385; devotee of golf, 385; death, 271, 385-6; his death a great loss to company, 386-7, 388; marriage, 142, 387; children, 295, 387; grandchildren, 387; name legally changed from Charles to Karl, 387; personal characteristics, 388-9
- Roebling, Mrs. Karl Gustavus (Blanche Estabrook), 142, 295, 387. *See also* O'Brien, Mrs. Arthur
- Roebling, Laura. *See* Methfessel, Mrs. Anton Gottlieb
- Roebling, Margaret Johanna. *See* Perrine, Mrs. Frederick A. C.
- Roebling, Nicholas, 6
- Roebling, Paul, 384
- Roebling, Robert Clowry, 387
- Roebling, Mrs. Robert Clowry (Dorothy Ripley), 387
- Roebling, Dr. Rudolph Heinrich, 6
- Roebling, Siegfried, 276, 278, 383-4
- Roebling, Washington Augustus, comments on father's philosophy, 13; his *Early History of Saxonburg*, quoted, 37-40, 50-51, 60, 72, 156-7, 158, 159-66; his history of Roebling industry, quoted, 147-9, 332-66; characteristics of his writings, 155-6, 289, 331; personal characteristics, 155-6, 167-8, 273-5; birth, 156; grandparents, 156-7; childhood in Saxonburg, 156-66; education: under Julius Riedel, 158; in Pittsburgh, 160, 162-3; family moves to Trenton, 167; father's method of discipline, 167, 168-9, 172; knowledge of foreign languages, 169; student at Trenton Academy, 169-72; student at Rensselaer Polytechnic Institute, 104, 172-5, 326; gifts to Institute, 174, 278; begins work in Roebling mill, 102, 103, 175; works with father on Pittsburgh-Allegheny Bridge, 104, 176-7, 179, 181, 183, 184, 185-6, 187; letters to Swan from Pittsburgh, 176-87; impressions of Pittsburgh, 176-7, 179-82, 184; slight accident, 183-4; returns to Trenton, 188; enlists in Company A, National Guard, 189; official record of Civil War services, 189-90; reenlists in 6th New York Artillery, 189-90; transferred to staff of General McDowell, 190; constructs suspension bridge across Rappahannock River, 190; serves on staff of General Pope, 190; at Bull Run, Antietam and South Mountain, 190-1; builds and repairs bridge at Harper's Ferry, 191, 221-2; reconnoiters daily from captive balloon, 191; returns to Trenton for map of Pennsylvania, 191-2; plays important part at Battle of Gettysburg, 191-2; on staff of General Warren, 192-3, 196-7, 226; assists in destruction of Weldon railroad, 193, 231-2; appearance and manner, 195-

INDEX

- 6; brevetted for gallant conduct, 190, 196; resigns from the army, 196; tries to enlist in Spanish-American War, 190; letters to Swan, 1861-64, 198-232; marriage, 233; assists father in building Cincinnati-Covington Bridge, 233-6; makes trip to Europe to study caisson construction, 234, 240; birth of son in Muhlhausen, 234, 383; letters to Swan from Cincinnati, 234-6; succeeds father as chief engineer of Brooklyn Bridge, 130, 239-47; home in Brooklyn, 139, 240, 244, 254; stricken in health, 139, 243-4, 260, 311; assistance of wife in carrying on work, 233, 244-5; trip to Europe to regain health, 246; temporary residence in Troy, 260; removes to Trenton and erects home, 260; receives Cup for long service in Roebling Company, 261; serves as presidential elector, 261; loyal citizen of Trenton, 261-2, 277; gifts to Public Library, 261-2; his literary tastes, 262; his handwriting, 263, 265; his enjoyment of picture puzzles, 263-4; his mineral collection, 264-8; his love of flowers, 268-9; death of wife, 269; second marriage, 269-71; reassumes presidency of Roebling Company, 271-2, 331, 389; his philosophy of life, 272-3; his dog, "Billy Sunday," 272, 274; his religious views, 275-6; death and burial, 276-7; his estate, 278; some "obiter dicta," 279-85; memoir of his brother, Ferdinand, 289, quoted, 303-9; known to the public as "the" Roebling, 303; memoir of his brother, Charles, 310, 324-8; letter to Mrs. Stockton at time of Charles's death, 329; loses \$75,000 in incandescent light business, 342; opposes formation of Roebling Construction Company, 352-3; resolution on death of Karl G. Roebling, 386-7
- Roebling, Mrs. Washington Augustus (Emily Warren), first wife of Washington A. Roebling, 229, 233, 277, 315; assists husband during building of Brooklyn Bridge, 233, 244-5; death, 269
- Roebling, Mrs. Washington Augustus (Cornelia Witsell Farrow), second wife of Washington A. Roebling, 269-71, 276
- Roebling, Washington Augustus, III, 315; death in *Titanic* disaster, 314, 327
- Roebling, New Jersey, library the gift of W. A. Roebling, 262; founded to provide for expansion of business, 359, 367; selection of site, 359-60, 367-8; housing of the workmen, 361, 368-9, 371, 373; town planned by C. G. Roebling, 313, 361, 369-70; plants erected by him, 313, 360-5, 369; policy of Roebling company, 370-1, 373; a progressive town, 372; name changed from Kinkora to Roebling, 372-3; population, 373. *See also* Roebling, John A., Sons Company: ROEBLING PLANT
- Roebling Company. *See* Roebling, John A., Sons Company
- Roebling Construction Company, 352-3
- Roebling family, in Germany, 5-9; in United States, 9, 166; *For Roebling family in Trenton see* names of individual members of family
- Roebling monument in Cadwalader Park, 142-4
- roebblingite, named in honor of W. A. Roebling, 267
- Rogers, Dr. R. J., 95
- Rondout Creek Bridge, Kingston, New York, 380
- Royal Polytechnic Institute, Berlin, 8, 11, 12, 13, 43
- Rusling, James F., 206
- SAINT Francis Hospital, Trenton, 392
- Sandy and Beaver Canal, 44
- Saxonburg, Pennsylvania, 9, 43, 46, 60, 83, 179; early inhabitants of, 22, 41, 156-7, 158-61, 163-4, 165-6; *Early History of . . .*, quoted, 37-40, 50-51, 60, 72, 156-7, 158, 159-66; founded

INDEX

- by Roebling brothers, 27-8, 37-41;
removal of wire rope factory from,
60, 61, 72-3, 77; discovery of oil in,
60; travel between Pittsburgh and
Saxonburg, 162-3; social life, 163-4
- Schlatter, Charles L., 46, 58-9
- Schneider, Charles C., 18
- Schuyler, Montgomery, *The Bridge as
a Monument*, 237; quoted, 254-6
- Sherman, Major, 199
- Shilly, Mr., postmaster, 156
- Shippy, Mr., Roebling agent, 346
- Sickels, General D. E., 193
- Sickels, Mrs. "General," 206
- Smithsonian Institution, 264, 268
- Staly, Mrs., 162
- Standard Fire Insurance Company, 293
- State Model School, Trenton, 170, 384,
389
- steel industry in Trenton, 73-5
- Stephenson, Robert, 119
- Stevens, D. G., 106-7
- Stewart, John H., 97, 147
- Stewart, Mrs. John H. (Elvira Roeb-
ling), 97-8, 114, 147
- Stockton, Mrs., letter to, from W. A.
Roebling, 329
- Stokes, Edward Ansley, 150
- Stokes, Edward C., 142
- Stokes, Edward H., 150
- Stone, General C. P., 201, 202, 203
- Storrs, Dr. Richard S., 252
- Stranahan, James S. T., 252
- Stryker, William S., *The Battles of
Trenton and Princeton*, 171
- Stuart, Charles B., *Lives and Works of
Civil and Military Engineers*, quot-
ed, 61-2, 119-22, 129-30, 140-1
- Stueller, Friederich August, friend of
J. A. Roebling, 12
- Sunderland, C. C., chief bridge engineer
of Roebling Company, 92, 382; au-
thor of chapter on George Washing-
ton Bridge, 399
- suspension aqueducts, built by J. A.
Roebling, 61-2, 64, 77, 82
- suspension bridges, J. A. Roebling's
early interest in, 13-4, 54-5, 62, 90-1,
119-21; Charles Ellet's work in build-
ing, 54-8, 117-19, 122; early history of,
115-17; first railway suspension
bridge constructed by J. A. Roebling,
117, 119; comparison of modern, 404.
See also Bear Mountain Bridge, Brook-
lyn Bridge, Cincinnati-Covington
Bridge, Delaware River Bridge, Fair-
mount Bridge, George Washington
Bridge, Greensburg Bridge, Kentucky
River Bridge, Manhattan Bridge,
Mid-Hudson Bridge, Monongahela
Bridge, Niagara Falls Bridge, Ohio
River Bridge, Oil City Bridge, Park-
ersburg Bridge, Pittsburgh-Allegheny
Bridge, Regnitz River Bridge, Rond-
out Creek Bridge, Williamsburg
Bridge
- Swan, Charles, birth and early life, 77;
works with J. A. Roebling on Alle-
gheny aqueduct, 77; becomes super-
intendent of Roebling works in Tren-
ton, 77-8, 146, 148-9, 150, 304, 332;
letters from: Houten, Colonel, 220-1,
Roebling, F. W., 290-1, Roebling, J.
A., 78-80, 82-4, 93-4, 95-6, 96-7, 98-
108, 109-14, Roebling, W. A., 173-4,
175, 176-87, 198-232, 234-6; legacy
from J. A. Roebling, 81, 145; retire-
ment, 149-50, 304; death, 150; de-
scendants living in Trenton, 150
- Swan, Charles Edward, 150
- Swan, Charles Henry, 150
- Swift, General Joseph G., 131
- Syracuse, Rochester and Eastern Rail-
road, 293
- TENNSTEDT, 6
- Thuringia, 3, 6
- Titanic* disaster, W. A. Roebling, III,
loses life in, 314, 327
- Tolly family, in Saxonburg, 166
- tramways, wire rope, 339
- transatlantic telegraph, J. A. Roebling's
views regarding, 87-8
- Trent, William, 150
- Trenton, 37, 188; selected as site of J.
A. Roebling's wire rope factory, 60,
73-6; early iron and steel industry
in, 73-5; Roebling monument in, 142-
4. *See also* Roebling, John A., Sons

INDEX

- Company: TRENTON PLANT, and names of individual members of Roebling family
- Trenton Academy, 169-72, 290
- Trenton Brass and Machine Company, 293
- Trenton Chamber of Commerce, 261
- Trenton Country Club, 293
- Trenton Free Public Library, 261-2, 293
- Trenton Hall and Building Association, 293
- Trenton Iron Company, 73-4, 75, 102
- Trenton Junction, 294
- Trenton Orthopedic Hospital, 392
- Trenton Philosophical Society, 86
- Trenton Times Civic Cup, awarded to F. W. Roebling, Jr., 391
- Trenton Water Board, 314, 391
- Tuple, Harry, 248
- Tyrell, Henry Grattan, *History of Bridge Engineering*, quoted, 115-16, 118, 122
- Tyson, Carrol Sargent, Jr., 315
- Tyson, Mrs. Carrol Sargent, Jr. (Helen Roebling), 315, 316
- Tyson, Charles, 315
- Tyson, Helen, 315
- UNGER, Dr. Ephraim Solomon, 11-12
- Union Industrial Home, Trenton, 146
- Union Mills Paper Manufacturing Company, 393
- United Power and Transportation Company, 293
- United States Steel Corporation, 73, 352, 365
- Universal Paper Bag Company, 293, 393
- VAN DER BOSCH, William, 248
- Van der Elst, Baron Joseph, 387
- Van der Elst, Baroness Joseph (Allison Roebling), 387
- Vanderbilt, William H., 312
- Voorhees, Daniel S., 302
- WARD, Henry A., 267
- Warren, Emily. *See* Roebling, Mrs. Washington Augustus
- Warren, General Gouverneur K., 195, 226, 233; at Gettysburg, 192
- Warren, Sylvanus, 233
- Wartburgh Orphans' Farm School, Mount Vernon, New York, 146
- Washburn mills, Worcester, competitor of Roebling Company, 333, 336
- Washington, George, 381
- Washington, Mary, statue of, 194
- Washington, D.C., F. W. Roebling's impressions of, 290-1
- Wayne, "Mad Anthony," 381
- Webb, Major, 214
- Weimar, 3
- Weymar, Maria Elizabetha. *See* Roebling, Frau Hermann Christian
- Wheeling, West Virginia, bridge at, 117-18
- White, Ferdinand Roebling, 393
- White, Margaret Roebling. *See* Cook, Mrs. George Rea
- White, William Townsend, 295, 393
- White, Mrs. William Townsend (Augusta Henrietta Roebling), 294, 295, 393
- White and Hazard, builders of first wire suspension bridge, 117
- Wickenhagen, Saxonburg colonist, 163
- Widows' and Single Women's Home, Trenton, 146
- Wilkins, Judge, 180
- Williamsburg Bridge, over East River, 379, 390, 404; cables built by C. G. Roebling, 312, 328, 349-52, 362
- Winkler, J. K., *Morgan the Magnificent*, 191
- wire, binder, 305, 334; copper, 340-2, 346; enamelled, 342; flat, 307, 335, 340, 358-9, 365; galvanized, 271, 304, 332-3, 337-8, 364, 376; insulated, 307, 340-2, 343; magnet, 342; steel, 105, 335-6, 337, 346, 375; telegraph, 333, 359; wire cloth, 305, 334-5, 352, 365, 373; wire drawing, 336-7, 340-1; wire nails, 335. *See also* wire rope
- wire-cable spinning, parallel, 376-9
- wire rope, replaces hempen cables on portage railways, 48, 50, 51-4, 61; first wire rope factory, in Saxonburg,

INDEX

- 50-1, 72-3, 158; increased demand for, 58-61, 83; Roebling industry removed to Trenton, 73-8, 81-3, 84-5, 91; progress of industry (1850-70), 88-9, 108-9, 145, 148-9, 303-4; patents, 90, 91; stores, 235-6, 346; Bessemer steel wire used for, 337; long ropes for cable roads, 338, 339; rope shops, 338-9, 347-9, 355-6; for elevators, 149, 304, 338, 347; tramways, 339; demand for, during World War, 355, 356-8, 385, 394-8. *See also* Roebling, John A., Sons Company
- Woodbury, General D. P., 222
World War, part played by Roebling industry in, 356-8, 385, 394-8
- YARD, Benjamin, 75
- Young, Andrew, correspondence with J. A. Roebling, 57-8
- Young, Charles, 248
- Young, Jesse Bowman, *The Battle of Gettysburg*, quoted, 192
- Zschokkes, Heinrich, *Hours of Devotion*, 160

